Report of Dr. Kevin Neels Concerning

UPS Proposals One, Two, and Three

October 8, 2015

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I. Introduction

A. Biographical Sketch

My name is Dr. Kevin Neels. I am a Principal at The Brattle Group, an economic consulting firm headquartered in Cambridge, Massachusetts. I lead that company's transportation consulting practice. I have more than 30 years of experience providing economic analysis, research, and consulting services to a wide range of clients. These clients have included government transportation agencies, as well as firms in the parcel, railroad, airline, and auto manufacturing industries. My work has frequently addressed issues relating to regulatory policy and the proper relationship between the public and private sectors. I have previously submitted testimony before a number of different regulatory bodies. I have also testified in international arbitrations, and in state and federal courts.

I am a member of the American Economic Association and a former Chairman of the Committee on Freight Transportation Economics and Regulation of the Transportation Research Board, an arm of the National Academy of Sciences. Prior to joining The Brattle Group, I served with a number of other organizations, including Charles River Associates; the Rand Corporation; the Urban Institute; KPMG; and the consulting firm of Putnam, Hayes & Bartlett. I hold a Ph.D. from Cornell University. A copy of my resume is attached as Appendix A.

On a number of prior occasions, I have been asked to offer expert testimony in legal and regulatory proceedings, including testimony relating to postal regulation. In particular, I have testified on behalf of UPS before the Postal Regulatory Commission and its predecessor, the Postal Rate Commission (collectively, the "Commission"). In Docket No. R97-1, I submitted testimony discussing a statistical analysis of mail processing cost variability presented by Dr. Michael Bradley on behalf of the United States Postal Service. In Docket No. R2000-1, I submitted testimony criticizing an updated version of that same study. In that same proceeding I also submitted testimony on transportation costs. In R2006-1 I again submitted testimony on mail processing costs. I submitted testimony on behalf of the Public Representative in N2012-1 on the regulatory implications of relaxing market dominant product service standards in the context of price cap regulation. In RM2015-7 I submitted a number of reports addressing the

variability of city carrier delivery costs, and both presenting and critiquing econometric studies designed to measure that variability.

B. PURPOSE OF THIS REPORT

UPS has asked me to consider in this report three questions. The first has to do with how inframarginal costs, which are a category of costs that have traditionally been included within institutional costs and which I describe in more detail below, should be treated for regulatory purposes. The second has to do with whether and to what extent the actual changes in Postal Service costs that have occurred in recent years are consistent with assumptions underlying Postal Service costing procedures about which of its costs are fixed. The third has to do with the share of fixed costs that should be covered by competitive products, which consist largely of the various package delivery services that the Postal Service regards as the future focus of its business.

To provide context for my discussion of those three questions, the remainder of this introductory section will provide an overview of recent postal trends, and then define certain relevant cost concepts as they are currently used by the Postal Service.

C. RECENT POSTAL TRENDS

In recent years the Postal Service has undergone a number of dramatic changes. Passage of the Postal Accountability and Enhancement Act of 2006 (PAEA) significantly changed the regulatory environment under which the Postal Service operates. The 2008-9 economic downturn, in combination with the dramatic expansion in digital communications, caused significant and continuing declines in revenue and mail volume. Especially hard hit have been the core letter mail services that have traditionally covered a major portion of the Postal Service's institutional costs.

The Postal Service has acknowledged the significance of the changes that have occurred in its business, and their implications for its ongoing viability. The Postal Service expects the decline in its traditional letter mail business to continue, and as a result has focused on growing its package

business. Numerous statements by Postal Service management reflect a belief that package delivery represents the future of the Postal Service.[1]

These various developments have substantially changed the composition of the mail stream handled by the Postal Service. Competitive products – which include the bulk of the package services that the Postal Service regards as its future – have grown substantially in revenue and volume even as its market dominant business has declined.

Figure 1 and Table 1 show the revenues earned by the Postal Service over the period from 2008 through 2014. Over this period, total revenues fell by $7.1 billion, or 9.5 percent. This decline in revenue was concentrated in market dominant products. Over the same period, the revenues generated by competitive products, in contrast, increased significantly, rising from $8.4 billion to $15.4 billion, or 22.6% of total postal revenue.

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[1] For example, in its 2014 Annual Report to Congress the Postal Service states at 46 that "The Postal Service is at the center of a rapidly evolving industry and is capitalizing on its strengths to grow its package delivery business. USPS shifted its focus this year from a cost-cutting position to a position focused on generating new revenue and exciting its customers. Innovative and creative initiatives are being implemented to adapt to the changing market, to drive value for our customers and build our capabilities for the future. The Postal Service is 'Delivering a New Day' by adjusting some shipping prices to attract more business customers and streamlining its mail processing operations so it can invest in new package sorting equipment and other upgrades."

Figure 1: Postal Service Revenue, by Product Category
2008-2014

Source: Fiscal Year Revenue, Pieces, and Weight Reports
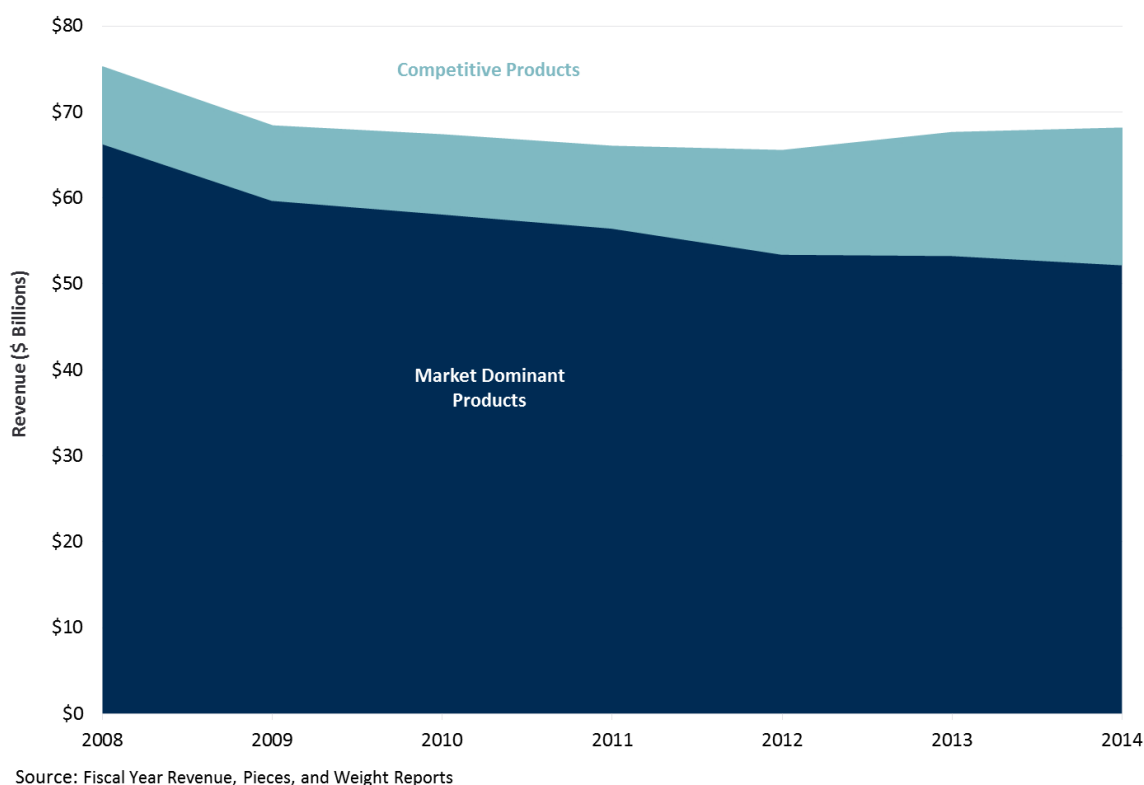
Table 1: Postal Service Revenue, by Product Category
2008-2014 ($ Millions)

		2008	2009	2010	2011	2012	2013	2014
Market Dominant Products	[A]	66,587	59,984	58,395	56,745	53,715	53,565	52,488
Competitive Products	[B]	8,382	8,132	8,682	8,994	11,532	13,776	15,367
Total	[C]	74,968	68,116	67,077	65,739	65,247	67,342	67,854
Percent Market Dominant	[D]	88.8%	88.1%	87.1%	86.3%	82.3%	79.5%	77.4%
Percent Competitive	[E]	11.2%	11.9%	12.9%	13.7%	17.7%	20.5%	22.6%

Notes and Sources:

Revenues from Fiscal Year Revenue, Pieces, and Weight Reports. Classification of products as market dominant or competitive reflects the classification in effect in each individual year.

[A]: Market Dominant includes Market Dominant Mail and Services and Other Market Dominant Revenue.

[B]: Competitive Products include Domestic Competitive Mail and Services and International Competitive Mail and Services.

[C]: [A] + [B].

[D]: [A] / [C].

[E]: [B] / [C].

Over this same period the total volume of mail delivered by the Postal Service – shown in Figure 2 and Table 2 – fell from 202 billion pieces to 154 billion pieces. Volume losses were also concentrated among market dominant products. Over the same period competitive product volume more than doubled, rising from 1.2 billion pieces to 3.2 billion pieces. Competitive products account for a smaller number of pieces than market dominant products. Piece counts, however, do not convey accurately the importance of these products or the burdens they place on Postal Service operations.

**Figure 2: Postal Service Volume, by Product Category
2008-2014**
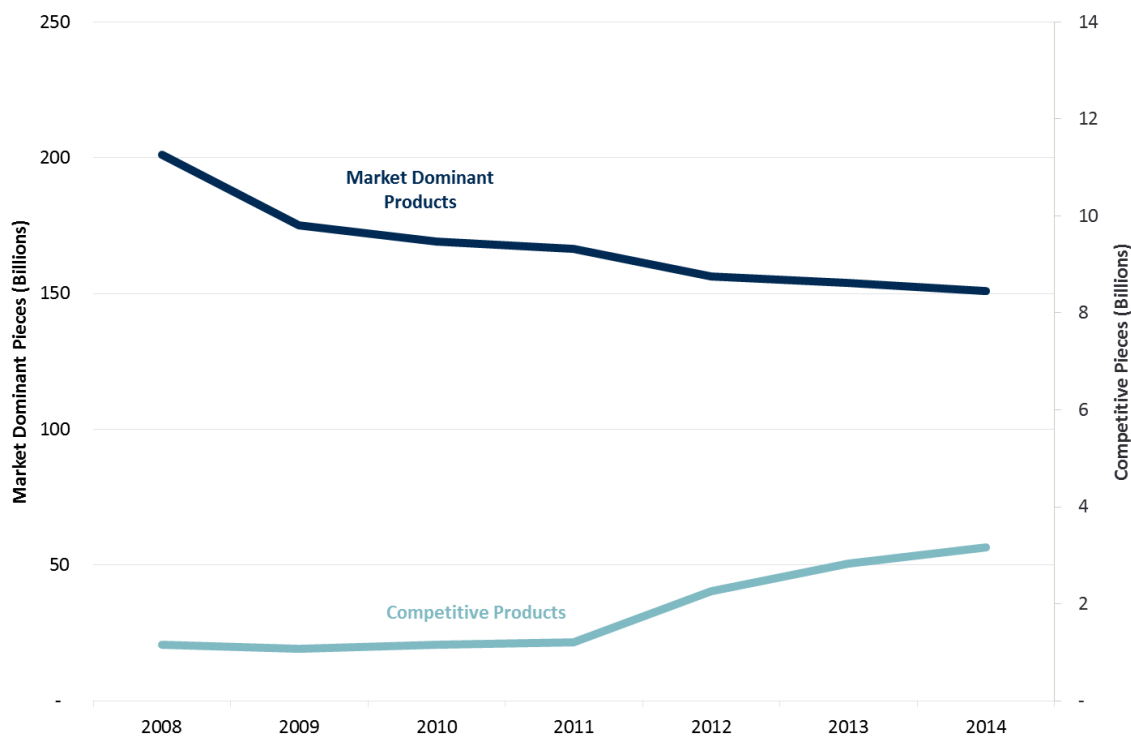
Source: Fiscal Year Revenue, Pieces, and Weight Reports

Table 2: Postal Service Volume, by Product Category
2008-2014 (Millions of Pieces)

		2008	2009	2010	2011	2012	2013	2014
Market Dominant Products	[A]	201,200	175,012	168,999	166,400	156,359	153,811	150,999
Competitive Products	[B]	1,161	1,079	1,150	1,213	2,261	2,823	3,168
Total	[C]	202,361	176,091	170,149	167,613	158,620	156,634	154,167
Percent Market Dominant	[D]	99.4%	99.4%	99.3%	99.3%	98.6%	98.2%	97.9%
Percent Competitive	[E]	0.6%	0.6%	0.7%	0.7%	1.4%	1.8%	2.1%

Notes and Sources:

Piece counts from Fiscal Year Revenue, Pieces, and Weight Reports.

[A]: Market Dominant Mail Classes include: Single Piece Letters, Single Piece Cards, Presort Letters, Presort Cards, First-Class Flats, First-Class Parcels, High Density and Saturation Letters, High Density and Saturation Flats and Parcels, Every Door Direct Mail Retail, Standard Mail Letters, Standard Mail Flats, Not Flat-Machinables and Parcels, In County Periodicals, Outside County Periodicals, Parcel Post / Alaska Bypass Parcels, Bound Printed Matter Flats, Bound Printed Matter Parcels, Media and Library Mail, U.S. Postal Service, Free Mail, Certified, COD, Insurance, Registered Mail, Carrier Route, Money Orders, and Other Ancillary Services.

[B]: Classification of products as market dominant or competitive reflects the classification in effect in each individual year. Included products are: Priority Mail Express, Priority Mail, First-Class Package Service, Parcel Return Service Mail, Parcel Select Mail, Standard Post, and Premium Forwarding Service.

[C]: [A] + [B].

[D]: [A] / [C].

[E]: [B] / [C].

Figure 3 and Table 3 provide a different perspective on the decline in mail volume that the Postal Service has experienced over this period, showing the change in *weighted* mail volume. Weighted volume takes into account the substantial differences in work content across the various mail products offered by the Postal Service. I compute weighted volume by multiplying the piece counts for the various postal products by their 2014 per unit attributable costs.[2] Like piece counts, weighted volumes have declined sharply over this period. However, because Figure 3 and Table 3 take into account the substantially greater per unit costs associated with competitive products, they show more clearly the growing importance of competitive products to overall postal operations, as overall mail volumes have declined. Specifically, while

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[2] As I discuss more fully below, attributable costs are the costs that the Postal Service currently associates with the provision of specific Postal products and services. Accordingly, the measure of weighted volume shown in Figure 3 and Table 3 relies on attributable costs as currently computed by the Postal Service.

competitive products account for only 2.1% of the Postal Service's piece count, they account for 25.0% of weighted volume.[3]

Figure 3: Weighted Mail Volume, by Product Category
2008-2014
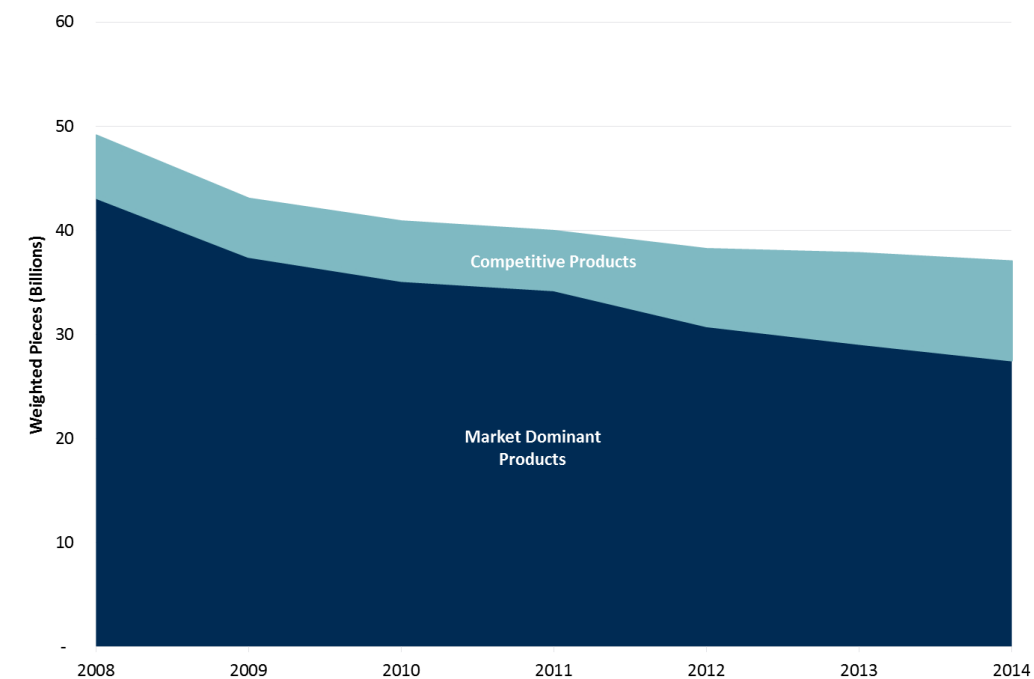
Source: Fiscal Year Revenue, Pieces, and Weight Reports and FY14 USPS CRA Model B Cost Matrix library reference.

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[3] Note that the calculation of both the 2.2% and 25.0% do not include international products.

Table 3: Weighted Mail Volume, by Product Category
2008-2014 (Millions of Weighted Pieces)

		2008	2009	2010	2011	2012	2013	2014
Market Dominant Products	[A]	43,272	37,590	35,279	34,380	30,933	29,233	27,640
Competitive Products	[B]	5,677	5,285	5,419	5,397	7,104	8,413	9,215
Total	[C]	48,949	42,875	40,698	39,777	38,037	37,646	36,855
Percent Market Dominant	[D]	88.4%	87.7%	86.7%	86.4%	81.3%	77.7%	75.0%
Percent Competitive	[E]	11.6%	12.3%	13.3%	13.6%	18.7%	22.3%	25.0%

Notes and Sources:

Piece counts from Fiscal Year Revenue, Pieces, and Weight Reports weighted by FY2014 Attributable Cost.

[A]: Market Dominant Mail Classes include: Single Piece Letters, Single Piece Cards, Presort Letters, Presort Cards, First-Class Flats, First-Class Parcels, High Density and Saturation Letters, High Density and Saturation Flats and Parcels, Every Door Direct Mail Retail, Standard Mail Letters, Standard Mail Flats, Not Flat-Machinables and Parcels, In County Periodicals, Outside County Periodicals, Parcel Post / Alaska Bypass, Bound Printed Matter Flats, Bound Printed Matter Parcels, Media and Library Mail, U.S. Postal Service, Free Mail, Certified, COD, Insurance, Registered Mail, Carrier Route, Money Orders, and Other Ancillary Services.

[B]: Classification of products as market dominant or competitive reflects the classification in effect in each individual year. Competitive Products include: Priority Mail Express, Priority Mail, First-Class Package Service, Parcel Return Service Mail, Parcel Select Mail, Standard Post, and Premium Forwarding Service.

[C]: [A] + [B].

[D]: [A] / [C].

[E]: [B] / [C].

D. THE COST STRUCTURE OF THE POSTAL SERVICE

Longstanding regulatory requirements have dictated that the Postal Service classify its costs into two categories: "attributable" costs and "institutional" costs. This categorization was established following the passage of the Postal Reorganization Act of 1970 that converted the Postal Service from a government department to its current status as an independent, self-supporting government entity,[4] and was maintained following the passage of the PAEA in 2006.[5] In this section, I discuss each of these terms and describe the various subcategories of costs that comprise each of these groupings. Where appropriate, I also draw distinctions between the terminology

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[4]   https://about.usps.com/publications/pub100/pub100_035.htm.

[5]   https://about.usps.com/transforming-business/postal-act-2006.htm.

used by the Postal Service and related terms traditionally used by economists. I then show the relative importance of attributable and institutional costs over the Postal Service's recent history.

1.   Attributable Costs

Attributable costs are those costs currently regarded by the Postal Service and the Commission as being associated with the provision of the various products and services. Currently, attributable costs are primarily comprised of two distinct cost subcategories: volume variable costs and product-specific fixed costs. *Volume variable costs*, as this term is used by the Postal Service, are defined as the volume of a specific product multiplied by the marginal cost of that product. It is important to note that the Postal Service's measure of volume variable costs does not correspond to the economic concept of variable cost.[6] Specifically, one subcategory of costs (inframarginal costs) currently classified as institutional are in fact also variable costs, as will be discussed below. Volume variable costs are the focus of traditional Postal Service cost attribution and make up the vast majority of attributable costs.[7] *Product-specific fixed costs*, which currently make up the remainder of attributable costs, are costs which do not vary with changes in the volume of any product, but are clearly incurred to support the provision of a single product.

2.   Institutional Costs

The other high level postal cost category has been termed *institutional costs*. Institutional costs currently include all costs other than attributable costs, and can be further broken down into two subcategories. The first is *fixed costs*, which are costs that do not change in response to changes in the volume of any product and are not incurred to support the provision of any specific product. The second subcategory is *inframarginal costs*, which are discussed below.

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[6]   These volume variable costs will only equal variable costs when marginal costs are constant (*i.e.,* there are no economies of scope or scale). This distinction will be further illustrated below. It is also discussed in greater technical detail in "The Role of Costs for Postal Regulation," by John Panzar.

[7]   Volume variable costs as measured by the Postal Service were $39.0 billion in FY2014, which represents 99.5% of attributable costs.

a.   *Inframarginal Costs Defined*

Inframarginal costs are variable costs that exist in the many areas of operations in which the Postal Service enjoys economies of scale that take the form of a cost structure in which the unit cost of handling additional mail pieces declines as overall mail volumes increase.[8]   In these components where the cost of each additional piece declines, the total variable costs incurred as volume changes exceed the Postal Service's measure of volume variable costs, as that term is used by the Postal Service. These additional variable, or inframarginal, costs arise because the "earlier" pieces of mail are more costly to process than "later" pieces.[9] These inframarginal costs have traditionally been included as part of institutional costs, even though they are variable costs and change as volume changes.

In 2014 a number of consultant reports solicited by the Postal Regulatory Commission focused on the role of inframarginal costs in postal costing and regulation.[10] In one of these papers, Charles McBride calculated the magnitude of these inframarginal costs for the years 2007 through 2013.[11] I have applied his methodology to the data for FY2014. These calculations demonstrate the large economic significance of inframarginal costs; for example, in 2014, 48 cost components in the USPS Public B Report contained inframarginal costs totaling $13.4 billion (or 18.3% of all USPS costs).[12]

Figure 4 provides an illustration of how inframarginal costs arise and where they fit into the overall cost structure of the Postal Service. The horizontal axis in this figure measures the quantity of the cost driver employed at current levels of operation (Q). Each cost component

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[8]   In more technical terms, the cost segments in question are those costs segments in which the elasticity of costs with respect to changes in volume is constant.

[9]   The terms "earlier" and "later" here should not be interpreted as referring to the temporal sequence with which mail pieces are processed, but rather to the contrast between a smaller operation, and a larger operation to which additional mail volume has been added.

[10]   See "The Role of Costs for Postal Regulation," by John Panzar, "The Calculation of Postal Inframarginal Costs," by Charles McBride, and "The Postal Service Variability Ratio and Some Implications," by Robert Cohen and John Waller.

[11]   McBride, Charles, "The Calculation of Postal Inframarginal Costs."

[12]   As described in further detail below, this figure is based on the application of Charles McBride's code to the USPS "Public B" data for FY2014.

containing variable costs has an identifiable cost driver that captures the main attribute determining how much cost is incurred. For example, for sorting costs, the cost driver is the number of pieces of mail handled. In some purchased transportation components, cubic foot miles is the cost driver.[13] In Figure 4, the vertical axis measures the marginal cost of producing an additional unit of the cost driver. This marginal cost decreases as the quantity of the cost driver increases. At the current cost driver level Q^*, the marginal cost is C^*. The rectangle bounded by the two dotted lines represents the Postal Service's measure of volume variable costs, while the area under the curve but above that horizontal line represents inframarginal costs. Both are costs that, unlike truly fixed costs, would decrease if the quantity of the cost driver decreased.

Figure 4: Illustration of Inframarginal Costs

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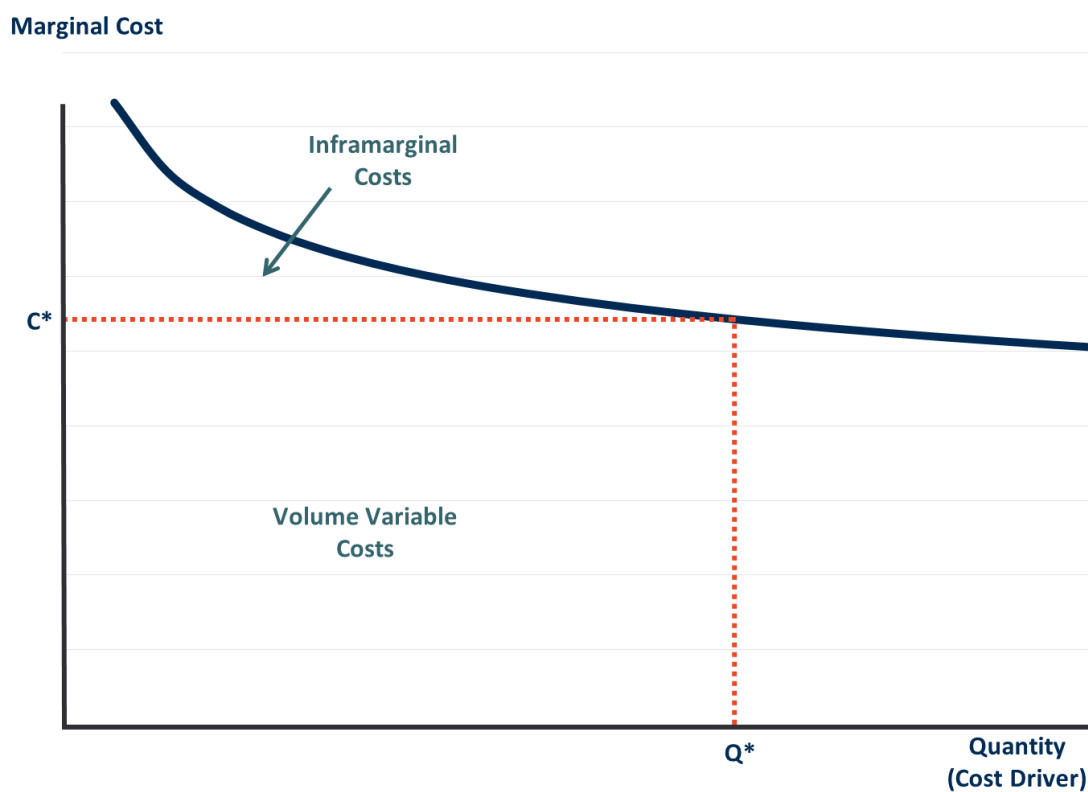
[13] Some components may have more than one cost driver (e.g. the number of letters and the number of flats), in which case weights can be calculated and applied to approximate the single-driver representation used in Figure 4.

3. Relative Importance of Attributable and Institutional Costs

For many years a large percentage of overall Postal Service operating costs have been regarded as institutional. The exact percentage has varied over the years.[14] This percentage reached a low point of roughly 35 percent in the late 1980s. More recently the institutional cost percentage has been somewhat higher. Table 4 shows how Postal Service costs have been divided between attributable and institutional over the periods from 2008 through 2014. I will focus on this time period in much of the discussion that follows. During this period the institutional cost fraction ranged from 38 percent in 2008 to 42 percent in 2014.[15]

Table 4: Division of Postal Service Operating Costs between Attributable and Institutional 2008 – 2014 ($ Millions)

		2007	2008	2009	2010	2011	2012	2013	2014
Attributable Costs	[A]	46,167	46,259	43,602	42,018	41,652	40,941	39,550	39,530
Institutional Costs	[B]	28,508	28,898	29,109	29,911	30,517	30,017	27,638	28,299
Total	[C]	74,675	75,157	72,711	71,930	72,170	70,958	67,188	67,830
Percent Attributable	[D]	61.8%	61.5%	60.0%	58.4%	57.7%	57.7%	58.9%	58.3%
Percent Institutional	[E]	38.2%	38.5%	40.0%	41.6%	42.3%	42.3%	41.1%	41.7%

Notes and Sources:

Nominal costs reported in Annual USPS CRA Model B Cost Matrix library references. Differences due to rounding.

[A]: Total Attributable Costs less Component 203: Annuitant Health Benefits – Pre-Funded (Prior).

[B]: Other Costs less Component 203: Annuitant Health Benefits – Pre-Funded (Prior).

[C]: [A] + [B].

[D]: [A] / [C]

[E]: [B] / [C]

Figure 5, below, provides an illustration of the relative importance of attributable and institutional costs, but also of the relative importance of the sub-categories that comprise each of the major categories. This figure reflects current Postal Service costing procedures.

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[14] Robert Cohen and John Waller "The Postal Service Variability Ratio and Some Implications," page 4. Note that for the purposes of their calculations, they exclude the congressionally-mandated "non-current" portion of the retiree health benefit fund payments. I believe this is appropriate and maintain that exclusion for the purpose of Table 4 and the associated discussion.

[15] If retiree health benefit fund payments are included, the institutional share has been as high as 50% (in 2012).

Figure 5: Postal Service Cost Structure, FY 2014
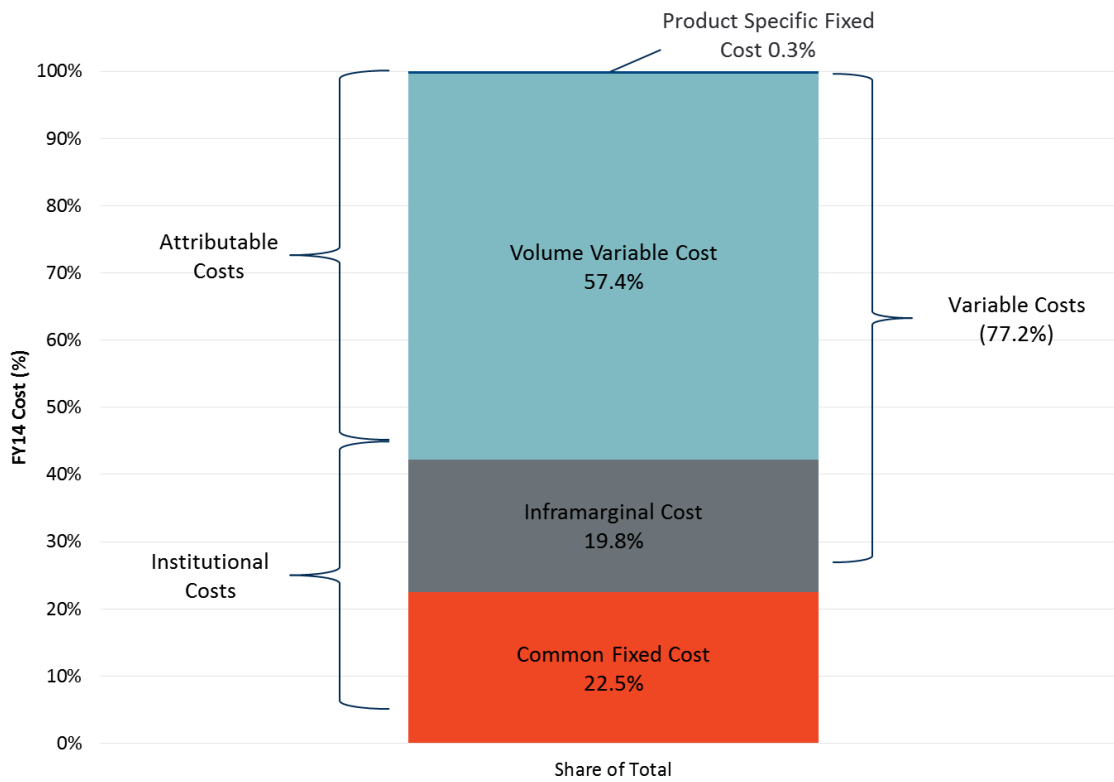
Source: PCRA, CRA Matrix B, McBride. Excludes Component 203: Annuitant Health Benefits - Pre- Funded (Prior).

In Figure 5 we can see that nearly half of so-called "institutional" costs are actually variable, and that attributable costs are made up almost entirely of what the Postal Service defines as "volume variable" costs. It also demonstrates the difference between the "institutional" and "attributable" cost categories used by the Postal Service and the terms "fixed" and "variable," as used by economists. In particular, inframarginal costs, representing nearly 20% of the entire costs of the Postal Service, are "institutional" under postal parlance, but these are decidedly not fixed costs and should not be thought of as such.

II. How Should Inframarginal Costs Be Treated For Regulatory Purposes?

One of the questions UPS has asked me to address is how inframarginal costs should be treated for regulatory purposes. For the reasons set forth below, I believe that inframarginal costs should be attributed to products in the same manner that the costs currently defined as volume variable costs are attributed to products.

A. HOW DO INFRAMARGINAL COSTS ARISE?

It is easy to envision situations in which the cost per piece of mail declines as the volume of mail increases. Consider, for example, the delivery of letters to a large neighborhood. If there were only a single letter to be delivered, the entire cost of the round trip from the delivery unit to the recipient address and back would be associated with that single letter. If there were a second letter to be delivered to the same neighborhood, the cost per letter would start to decline. Even if the two recipients were located some distance apart, the letter carrier would be able to carry out the deliveries by following a triangular route rather than two separate out-and-back round trips. Costs per piece would then continue to fall as volumes increased further. The Postal Service has also documented this phenomenon, noting, in connection with city carrier delivery activity that "delivery time per piece falls as the number of pieces delivered rises, but that effect tapers off as volume gets large. This is consistent with economies of density in delivery."[16]

The same general principles can be demonstrated numerically. Consider the production function depicted in Table 5. It shows that the marginal cost of producing the first unit is $1.00, the marginal cost of producing the second unit is $0.89, and so on. Note that the marginal cost continues to decrease with each additional unit, but by smaller and smaller amounts. For the purpose of this hypothetical example, I will assume that fixed cost is 0, an assumption which does not affect the point being made here.

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[16]   Docket RM2015-7, "Report on the City Carrier Street Time Study." December 2014, page 66.

Table 5: Hypothetical Production Function

Volume	Marginal Cost
1	$ 1.00
2	$ 0.89
3	$ 0.83
4	$ 0.79
5	$ 0.76
6	$ 0.74
7	$ 0.72
8	$ 0.71

Suppose there are two sources of volume (A and B) accounting for 3 and 5 units, respectively. The variable cost (and total cost) of producing volume A alone (3 units) is $2.72.[17] The Postal Service's volume variable cost in this case (the marginal cost at the current level of production, multiplied by volume) is 0.83 x 3 = $2.49. Subtracting volume variable costs from total costs leaves $0.23 in inframarginal costs: 2.72 − 2.49 = 0.23. One could also calculate inframarginal costs on a unit-by-unit basis: when the production level is 3, the first unit has $0.17 (1.00 − 0.83) of inframarginal cost "associated" with it, while the second unit has $0.06 of inframarginal cost "associated" with it. Together, they total the same $0.23 in inframarginal costs.

Next, consider the cost of producing only volume B: there are 5 units, so variable cost is thus $4.27.[18] The Postal Service's volume variable cost (the marginal cost at the current level of production, multiplied by volume) is 0.76 x 5 = $3.80, leaving $0.47 as the total inframarginal cost. Again, this cost can be calculated as 4.27 − 3.80 = 0.47, or it can be done on a unit-by-unit basis, where each unit's inframarginal cost is its marginal cost minus the marginal cost (0.76) at the prevailing volume level. For example, the inframarginal cost "associated" with the "first" unit is 1.00 − 0.76 = 0.24.

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[17] 1.00 + 0.89 + 0.83 = 2.72

[18] 1.00 + 0.89 + 0.83 + 0.79 + 0.76 = 4.27

Finally, the total cost of producing all 8 units is $6.44.[19] The total volume variable cost is now 0.71 x 8 = $5.68, leaving $0.76 in inframarginal cost. Note that the inframarginal cost "associated" with the "first" unit of volume is now 1.00 – 0.71 - $0.29. The additional volume has provided economies of scale, which has lowered volume variable costs for all units, thus increasing inframarginal costs.[20] In general, inframarginal costs increase and marginal cost decreases as volume increases.

B. WHY SHOULD INFRAMARGINAL COSTS BE ATTRIBUTED TO PRODUCTS?

There are a number of key reasons why inframarginal costs should be attributed to products. First and foremost is that they are variable costs. The second key reason is that all inframarginal costs can be shown to be causally linked to cost drivers and thus can be reliably attributed to products. Third, failure to attribute inframarginal costs distorts competition. I discuss each of these in turn.

1. Inframarginal Costs are Variable Costs

The simplest reason that inframarginal costs should be attributed is because they are variable costs; in fact they make up a large share – more than a quarter – of variable costs. Clearly, they change in response to changes in volume. As a result, they are caused by products, and would change if volume were to change. Referring again to Figure 4 from the Introduction, if quantity (and thus the level of the cost driver) were to increase, Q^* would shift to the right, C^* would fall, and inframarginal costs would increase. Similarly, if the quantity of the cost driver were to decrease, inframarginal costs would decrease. Inframarginal costs thus clearly represent a component of variable costs. I understand that the legal framework under which the Postal Service operates requires attribution of direct and indirect costs that can be reliably attributed to products, and that the Commission has stated on numerous occasions that variable costs should be attributed to products. By this standard, inframarginal costs clearly should be attributed to products.

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[19] 4.27 + 0.74 + 0.72 + 0.71 = 6.44. Equivalently, 2.72 + 0.79 + 0.76 + 0.74 + 0.72 + 0.71 = 6.44.

[20] If the two sources of volume are different products, the cost savings from producing both sources include what have been called by economists "economies of scope".

2. Inframarginal Costs Can Be Reliably Shown to Be Caused by Individual Products

A second key consideration is the fact that inframarginal costs are not only variable, but their existence can be reliably linked to individual products. We have seen that inframarginal costs are simply the difference between marginal costs for "earlier" units and the marginal cost at the prevailing quantity level. In the Postal Service setting, the relevant quantity in the components that give rise to inframarginal costs is the cost driver. As discussed above, each such component has one or more identifiable cost drivers that determine how much cost is incurred. These cost drivers are in turn directly related to products. In all components that give rise to inframarginal costs, existing Postal Service costing models rely on an understanding of how volumes of individual products translate into levels (or at least shares) of the total quantity of the relevant cost driver(s) for that component. These share measures are known as "distribution keys".

Distribution keys are currently used by the Postal Service to attribute volume variable costs to products. They are component-specific, and are based on accepted relationships between products and cost drivers within each component. They are readily-available tools that allow for the calculation of the proportion of each component's attributable cost that is assigned to each product.[21] Consider component 143 (highway transportation), where the cost driver is cubic foot miles. The Postal Service's Transportation Costs System (TRACS) is used to sample the mail stream and attribute costs. Within this particular component, roughly 45.7% of attributable costs are assigned to domestic competitive products (as a group) with the remainder (54.3%) attributed to market dominant and international products. The sampling system permits these costs to be further disaggregated to the product level.[22,23] Attribution of volume variable costs is

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[21] For some components, the distribution keys and the methods used in their construction are clear from the public library references produced in association with the Annual Compliance Determination. For other components, I use the term "distribution key" to refer to the distribution of volume variable costs across products in the final costing results for a given component. For each component, this distribution is readily observable in existing Postal Service costing calculations.

[22] To the best of my knowledge, there are no product-specific fixed costs in the components with inframarginal costs. Thus, attributable costs are equivalent to volume variable costs in the relevant components, and the distribution keys permit the calculation of each product's share of the cost driver within the relevant segments. In general, product-specific fixed costs represent only a minute share of total attributable costs.

significantly different for component 47 (city carrier delivery activities); roughly 11.4% of the volume variable costs for that component are attributed to domestic competitive products, while the remainder (88.6%) are attributed to market dominant and international products as a group.[24]

In short, the total amount of inframarginal cost in a component is directly related to the total amount of the cost driver(s) of a component, and the total amount of the cost driver is in turn a function of the quantities of the products whose provision relies on that cost category. More accurate attribution of variable costs to products would have implications for the prices the Postal Service sets for its products. Section 3633(a)(2) of PAEA establishes attributable cost as a price floor for each competitive product. This price floor is effectively a binding constraint for some competitive products.

3.   Failure to Attribute Inframarginal Costs Distorts Competition

Finally, failure to attribute inframarginal costs provides the Postal Service with an artificial cost advantage over its private competitors. Private companies that compete with the Postal Service do not have access to the production volumes that the Postal Service regularly obtains from its market dominant products. These volumes afford the Postal Service economies of scale that private competitors do not enjoy.

This is a critical competitive advantage for the Postal Service. In the presence of a declining marginal cost curve, adding more volume necessarily decreases the average cost per unit. Since the later units are cheaper than the former, average cost per unit goes down as volume goes up: the network becomes more efficient. Having access to a cache of protected volume that is uncontestable by your competitors is a huge advantage in these circumstances.

Continued from previous page

[23]   Here, I have only provided the attribution to competitive products as a group, relying on data contained in the FY14.B.Public.xls file within Library Reference 31 from the FY2014 ACR docket. The non-public version of that file permits further attribution to the product level. While I use that file in the analysis underlying this report, I do not provide here product-level attribution for specific cost components to competitive products for confidentiality reasons.

[24]   There is also substantial variation across components in the distribution of attributable costs *within* the groups of products I have identified here.

This artificial competitive advantage is amplified under current Postal Service costing. Under the current practice, the marginal cost of the *last* unit is considered to be the cost associated with all units. This practice understates the costs associated with all units except for the last unit, and yields cost estimates that are significantly below average variable costs. The huge advantage granted to the Postal Service in the form of lower average variable costs is amplified, allowing the Postal Service to price competitive products below average variable cost.[25]

Requiring the Postal Service to attribute inframarginal costs to products, including competitive products, is necessary to avoid providing the Postal Service with this significant, artificial competitive advantage. Competitive products would need to be priced approximately at average variable cost and significantly higher than marginal cost. This would bring the Postal Service closer to fair competition with its private competitors. In my opinion, this is consistent with ensuring a level playing field for the Postal Service and its private sector competitors.

C.   HOW CAN INFRAMARGINAL COSTS BE ATTRIBUTED TO PRODUCTS?

Having established that inframarginal costs should be attributed, a logical question is whether that can be reliably done using existing Postal Service costing models. In order to attribute inframarginal costs to products one must first calculate the amount of these costs, and then identify a reliable and appropriate methodology for distributing them to individual products. Both of these requirements can be readily met using existing Postal Service data sources and costing methodologies. Below I discuss each of these requirements in turn.

1.   Calculation of Total Inframarginal Costs

The machinery required to calculate and distribute inframarginal costs to mail classes already exists, and is submitted by the Postal Service each year as part of its Annual Compliance Report ("ACR"). The machinery in question is a model developed by the Postal Service to calculate *incremental* costs – the sum of volume variable, product-specific fixed, and inframarginal costs that would be avoided if some portion of volume were removed but the remaining volume were maintained.

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[25]   This shortfall is made up by raising prices above average variable costs for market dominant mailers who have traditionally borne the brunt of the Postal Service's "earlier" inframarginal costs.

Since 2006, only incremental costs for competitive products as a whole have been publicly submitted to the Commission for purposes of carrying out the incremental cost test (described below). The most recent version of this Incremental Cost Calculation Methodology is from Docket R2006-1, Postal Service-T-18 by Witness Pifer. As a part of each ACR, the Postal Service creates the non-public 'Competitive Product Incremental and Group Specific Costs' library reference which implements this methodology to estimate incremental costs, and thus inframarginal costs, for competitive products.[26] The Postal Service's documentation classifies each component's incremental cost methodology (i.e., constant elasticity, 100% attributable, dependent, etc.). Based on each component's attributable costs, other costs, and incremental cost methodology, the Postal Service calculates incremental costs and inframarginal costs for competitive products as a whole. In the 2014 ACR these results were filed in the NP10 library reference.

Although the Postal Service's models are currently used only to calculate the incremental costs associated with competitive products for the sake of a very specific and limited test, they can be readily modified to calculate total incremental and thus total inframarginal costs. In his report prepared on behalf of the Commission and cited above, McBride did this, using the Postal Service's models to calculate inframarginal costs for all products and all components in the CRA Public B Cost Matrix from FY2007 to FY2013 using each component's attributable and fixed costs from the annual matrices in conjunction with the Postal Service's incremental cost methodologies.[27] Below I present similar results based on the Postal Service's 2014 ACR filings.

2. Attribution of Inframarginal Costs to Products

A necessary second step, after inframarginal costs are calculated in each relevant component, is the attribution of those inframarginal costs to individual products, whether market dominant or

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[26] For FY14, "Postal Service-FY14-NP10 FY2014 Competitive Product Incremental and Group Specific Costs."

[27] McBride follows the Postal Service's incremental cost methodology for each component except some which are the sum of several more granular cost pools. For most of these aggregate components, he sets these components as constant elasticity in order to get a "relatively accurate estimate of system-wide inframarginal costs". I have applied McBride's computer programs to the FY2014 CRA Public B Cost Matrix in order to calculate inframarginal costs for FY2014.

competitive. In this section, I discuss a simple, fair, and appropriate method by which this can be done.

a. The Current Method of Assigning Inframarginal Costs to Competitive Products is Inadequate

While inframarginal costs are not currently attributed to products, the Postal Service does in fact calculate inframarginal costs for domestic competitive mail (as a group) as part of its annual calculation of incremental costs for that group of products, for compliance with section 3633(a)(1) of PAEA. In this calculation, the Postal Service is effectively comparing its total costs with competitive mail to its total costs in a hypothetical world where these products and services are not provided. Thus, it necessarily treats those mail volumes as the "last" pieces, and consequently it treats the associated increase in the cost drivers in the affected components as the "last" units of those cost drivers. As is now clear from both Figure 4 and from the hypothetical example discussed above, in the presence of declining marginal cost, this implicit ordering has the effect of decreasing the cost associated with the "last" units, here of competitive products, by assigning to them far lower inframarginal costs than the inframarginal costs associated with the "first" units. Indeed, while domestic competitive products and services bore 24.2% of total volume variable costs (equivalent to its share of total cost drivers) in FY2014, the incremental cost test, as currently applied, assigns only 1.6% of total inframarginal costs to these products.[28]

This incremental cost test, which is based on the test developed by Faulhaber,[29] seeks to answer the question of whether the revenues earned by competitive products exceed the incremental costs of producing those products. As such, it involves a comparison of two states of the world – one where the enterprise offers its current set of products and one where it offers all products other than competitive products. The costs calculated in this way represent the costs that the Postal Service would avoid if it were to shut down its competitive product business. The

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[28] The first calculation (24.2%) uses the Postal Service's volume variable costs as reported in the Public CRA for FY2014. The second calculation compares inframarginal costs assigned to competitive products (as reported in the "IC2014.ICSummaryRpt.xls" workbook in FY2014 Library Reference NP-10) to the total calculated by applying McBride's computer program to FY2014 data.

[29] Faulhaber, Gerald R., "Cross-Subsidization: Pricing in Public Enterprises," The American Economic Review, Vol. 65, No. 5 (1975): pp. 966-977

comparison between these costs and the revenues earned by competitive products indicates whether the Postal Service would be better off financially if it were to exit its competitive products business.

But that is not the question being posed here. In answering the question being posed here – how to appropriately attribute inframarginal costs to products – the use of an "ordered" methodology like that used in the incremental cost test would be wholly inappropriate, because there is no principled basis for ordering products along the marginal cost curve shown in Figure 4. Due to the presence of declining marginal costs in several key components, the use of an ordered methodology to attribute inframarginal costs would implicitly and arbitrarily make some units of the cost driver more expensive than others, and would thus allow some products (or groups of products) to benefit from the economies of scope and scale while others would bear a disproportionate share of the additional costs incurred in attaining those efficiencies. To avoid this problem and treat all products comparably, an appropriate attribution methodology should use an order-independent approach. Fortunately, such an approach exists and can be applied here.

b. *Shapley Values Provide a Basis For Distributing Inframarginal Costs Using Existing Distribution Keys*

The Shapley Value, which is based on the work of Lloyd Shapley, provides a solution to the problem of how to attribute cost responsibility in a manner that is independent of the order in which products are considered. For their work in this area Lloyd Shapley and Alvin Roth were awarded the Nobel Prize in economics in 2012.

The Shapley value was originally introduced by Shapley in 1953 as a solution concept in cooperative game theory.[30] Cooperative game theory concentrates on the division of gains achieved through cooperation.[31] In the context of such a game, a coalition of players cooperates and through cooperation achieves some benefit that they could not obtain individually. In the context of cooperation across different products or divisions within a firm, such a benefit could

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[30]   Roth, Alvin E. (editor), "The Shapley Value, Essays in Honor of Lloyd S. Shapley," Cambridge University Press, Cambridge, (1988).

[31]   Aumann, R., "An Interview with Robert Aumann," Macroeconomic Dynamics Vol. 9 (2005): 683-740.

take the form either of increased revenue, or avoided cost. The Shapley value generates a unique distribution of the total benefit of a game among the participating players, given their different situations and bargaining powers.

To illustrate the intuition behind this approach, consider a coalition being formed one player at a time. As a condition for joining the coalition, each player demands his individual incremental contribution to total surplus. However, the magnitude of a player's contribution will generally depend upon the number and identity of the payers that have already joined the coalition. Each possible sequence of decisions to join the coalition could potentially result in a different set of incremental contributions. The Shapley value calculates the average of a player's incremental contributions over all possible sequences in which players join the coalition.

The Shapley value has been applied to the problem of how to allocate common costs. In particular, it has been shown to provide solutions such that the allocation of costs is robust to changes in the ordering of the various services that share those costs. Application of the Shapley value as a cost allocation mechanism has been studied in a variety of different contexts, including determining a fair allocation of total costs incurred by countries in pollution reduction;[32] transmission cost allocation in the competitive power market environment;[33] cost allocation in water resources development;[34] cost allocation of runway cost among different sized aircraft;[35] and postal costing issues arising under 39 U.S.C. § 3633.[36]

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[32] Petrosjan, Leon, and Georges Zaccour. "Time-Consistent Shapley Value Allocation of Pollution Cost Reduction." Journal of Economic Dynamics and Control Vol. 27 No. 3 (2003): 381-398.

[33] Tan, X., and Lie, T.T., "Application of the Shapley value on Transmission Cost Allocation in the Competitive Power Market Environment." IEE Proceedings-Generation, Transmission and Distribution Vol. 149 No. 1 (2002): 15-20.

[34] Young, H. Peyton, Norio Okada, and Tsuyoshi Hashimoto. "Cost Allocation in Water Resources Development." Water Resources Research Vol. 18 No. 3 (1982): 463-475.

[35] Dubey, Pradeep. "The Shapley Value as Aircraft Landing Fees-Revisited." Management Science Vol. 28 No. 8 (1982): 869-874.

[36] Sidak, J. Gregory. "Maximizing the U.S. Postal Service's Profits from Competitive Products." Journal of Competition Law and Economics Vol. 11 No. 3 (2015): 617-699.

The Shapley value provides a solution to the problem of how to attribute inframarginal costs in a manner that is not sensitive to the order in which products are considered. We saw previously that, due to economies of scale that have been estimated in the course of Postal Service costing procedures, the marginal cost of producing the "first" unit can be much higher than the marginal cost of producing the "last" unit. There is no principled way to determine where along this continuum any class of products, individual product or individual mail piece belongs.

By way of illustration, consider the two alternative orderings presented in Figure 6 and Figure 7. In this hypothetical example, there are five products, all responsible for a certain share of the cost driver. In Figure 6, the products are ordered alphabetically, while the order is changed slightly in Figure 7. For all five products, the amount of inframarginal cost (the area between the red dotted line and the marginal cost curve) changes significantly based on the order in which they are considered.

Figure 6: One Potential Ordering of Products
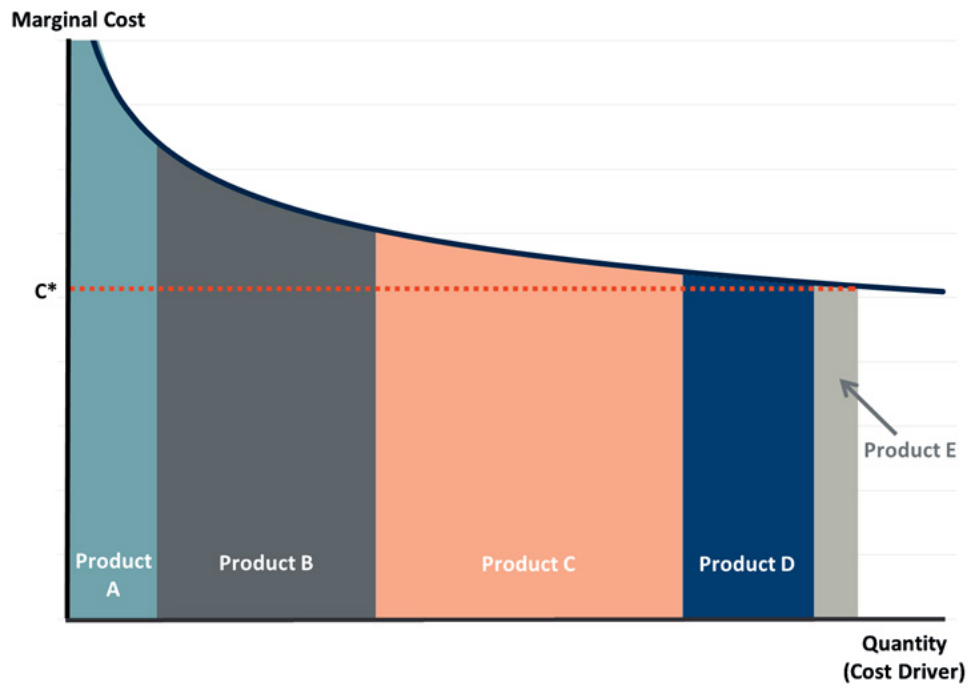
Figure 7: Alternative Ordering of Products
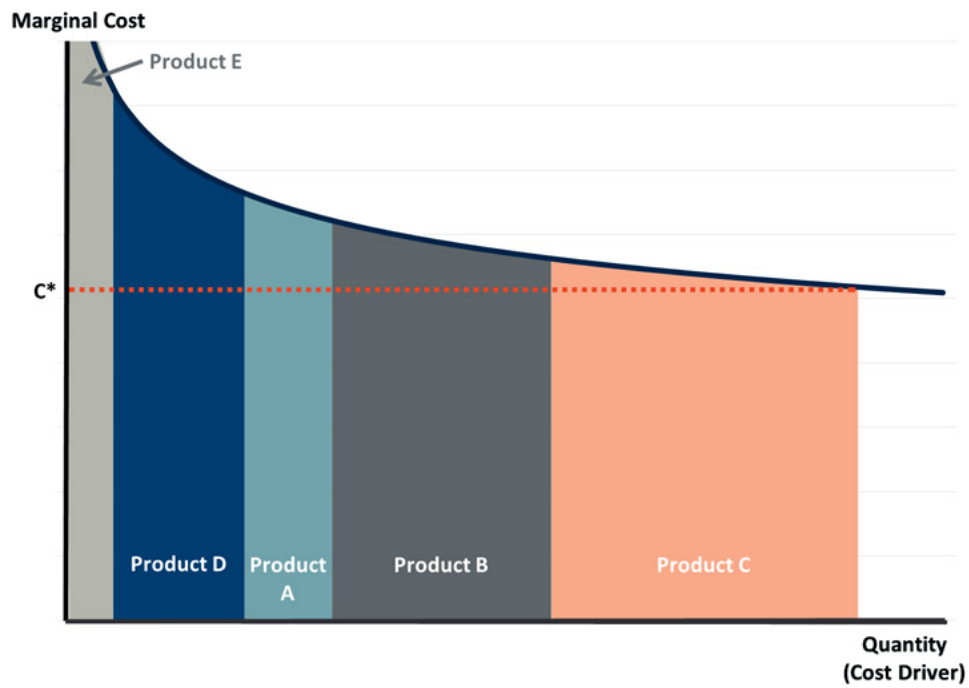
The Shapley approach avoids having arbitrary ordering decisions dictate the results. Instead, it solves this problem by considering all possible orderings and averaging the inframarginal cost assignments resulting from all of these alternative orderings. In this hypothetical example, we have made the product the unit being ordered. While this type of approach would be acceptable, it can be shown to result in a slight over-attribution of inframarginal costs to small products, and a slight under-attribution to large products when compared with an approach that uses a more granular unit (such as a piece of mail or the unit of the cost driver) as the unit of analysis. A more granular approach to the hypothetical example presented above is illustrated in Figure 8; here I have provided one possible ordering, which results in the units of the cost driver associated with a given product being scattered along the horizontal axis.

Figure 8: One Potential Ordering Where the Unit of Analysis is a Unit of Cost Driver
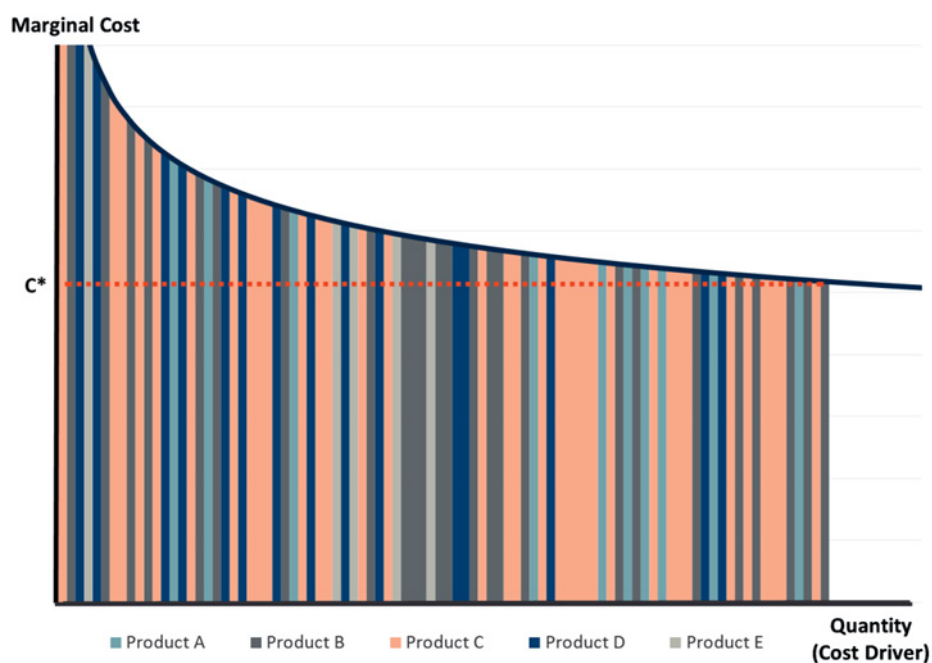
At first, this more granular approach appears to pose computational problems; as the number of items to be considered grows, the possible number of orderings that must be evaluated in order

to compute the Shapley value grows very quickly.[37] However, it is not generally necessary to consider all possible orderings, as a simple mathematical observation can be used to make the calculation of Shapley values a much easier problem to solve. Note that when units of the cost driver are used as the unit of analysis, each unit of the cost driver would take each potential "slot" along the marginal cost curve an equal number of times. A visual example of how this process would work is provided in Figure 9. Here, I have chosen one specific unit of the cost driver associated with Product C, which I will call unit c_1, and highlighted the "slot" in which it appears in four randomly-selected potential orderings of the 90 units in my hypothetical example. In some of these orderings, the amount of inframarginal cost is relatively high, while it is relatively low in others. If all potential orderings were to be considered, unit c_1 would appear in each of the 90 slots with probability 1/90. Thus its Shapley value with respect to inframarginal costs would simply be an average of the inframarginal cost associated with each "slot".[38]

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[37] To be precise, if there are N products, there are N! possible orderings, where N! = N*(N-1)*(N-2)*…*3*2*1. For example, 6! = 6*5*4*3*2*1 = 720.

[38] There are a very large number of potential orderings of the 90 units of this cost driver, and that number would be even larger when the actual number of units of a cost driver are considered. However, the overall point being illustrated here – that this reduces to averaging inframarginal costs per unit of the cost driver – will not be sensitive to the number of those units.

As discussed above, some components which contain inframarginal cost have multiple cost drivers. However, we can use the relative weights assigned to the various cost drivers within those components' costing methodologies to invoke the same rationale and arrive at the same result as is illustrated here.

Figure 9: Four Potential Positions of Cost Driver Unit c_1 in Hypothetical Example
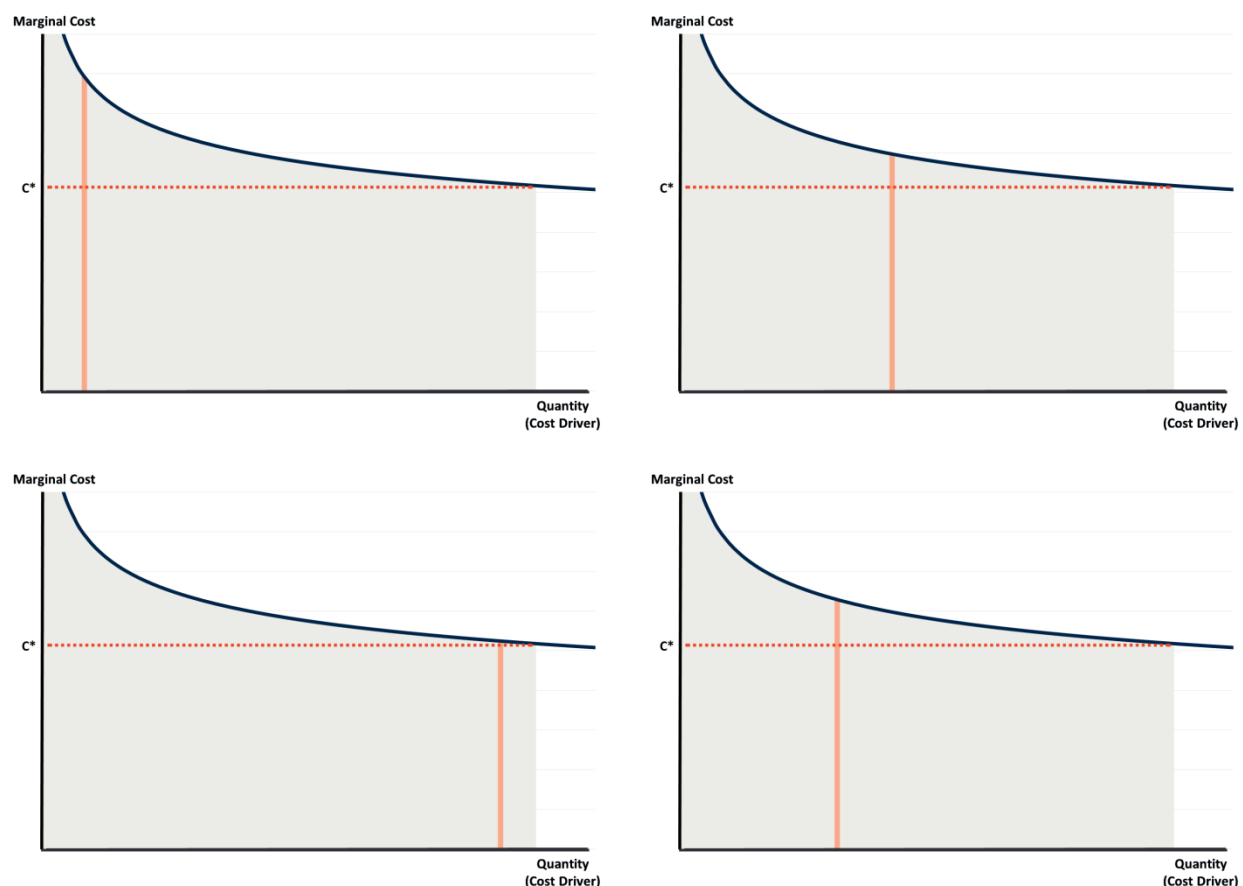
Thus, under a Shapley value approach each unit of the cost driver would share equally in the attribution of inframarginal cost. Each cost driver unit is assigned the average inframarginal cost per cost driver unit. The inframarginal costs assigned to any particular product under this approach would thus be equal to that product's share of the distribution key for that cost driver. We thus arrive at the simple, straightforward and reasonable result that the implementation of the Shapley value approach to the assignment of inframarginal costs to products is equivalent to assigning inframarginal costs using the same distribution keys (whether explicit or implicit) used to assign volume variable costs. Furthermore, the Shapley value results in a complete and exact allocation of all inframarginal costs.

This is essentially equivalent to using existing distribution keys to attribute inframarginal costs. For example, if priority mail is assigned 15% of attributable costs within a particular component, it is because priority mail has been calculated to be responsible for 15% of the total quantity of

the cost driver in that component, and it would be reasonable and appropriate to assign this same share of total inframarginal costs within that component to priority mail.

D. IMPACT ON COST ATTRIBUTION

I have calculated the impact of attributing inframarginal costs to products in this manner. Table 6 displays those impacts at the aggregate level for market dominant and competitive products, and provides product-level detail (consistent with the level of detail produced in the Postal Service's CRA reports) within the competitive products group. The exact impact of attributing inframarginal costs depends on the relative importance of various products in the components that bear the highest level of inframarginal costs.[39] At the aggregate level, attributable costs increase by as little as 16% (for Competitive International) or by as much as 38% (for market dominant mail and services).[40] There is also substantial variation within products, as the competitive detail shows.

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[39] This impact analysis assumes that the Postal Service is using its legacy City Carrier Street Time model from before Docket RM2015-7. Since City Carrier Street Time contains a high proportion of inframarginal costs, the outcome of that docket will have implications for the impact of Proposal One.

[40] Although I report the "impact" on market dominant products, I note that the prices of market dominant products are governed by the "rate cap" and hence are not generally sensitive to changes in cost attribution.

Table 6: Proposal One Cost Impact w/ Domestic Competitive Detail (FY14 $ Millions)

Mail Class	Current Methodology	Inframarginal	Proposal One	% of Current Costs
[1]	[2]	[3]	[4]	[5]
Total Market Dominant (MD) Attributable Costs	**28,205**	**10,717**	**38,922**	**138%**
Priority Mail Express	366	124	490	134%
First-Class Package Service	1,155	302	1,456	126%
Priority Mail	5,234	1,204	6,439	123%
Ground	2,472	837	3,309	134%
Competitive International	1,385	219	1,604	116%
Domestic Competitive Services	359	2	360	100%
Total Competitive (CP) Attributable Costs	**10,970**	**2,688**	**13,658**	**125%**
TOTAL ATTRIBUTABLE COSTS	**39,175**	**13,406**	**52,581**	**134%**
OTHER COSTS	34,187	(13,406)	20,781	61%
TOTAL COSTS	73,362		73,362	

Notes and Sources:

[1], [2]: Mail classes as reported in the FY14 Public Cost and Revenue Analysis (PCRA). Note that these costs differ slightly from those shown in Component 460 in FY14 CRA Cost Model B (CRA B).

[3]: Inframarginal Costs calculated following McBride's methodology applied to 2014.

Estimated International Inframarginal costs are split between MD and CP based on the ratio of 'Total Competitive International' Attributable Costs reported in the PCRA to 'International Mail and Services' Attributable Costs for Component 460 reported in CRA B.

[4]: [2] + [3].

[5]: [4] / [2].

III. Have Actual Cost Trends Been Consistent With Postal Service Costing Assumptions?

As I have noted above, in recent years the Postal Service has experienced historic changes in volume, revenue and the mix of products it handles. A question that arises naturally after considering these changes is whether the actual changes in costs that have occurred over this period have been consistent with the assumptions underlying Postal Service costing procedures.

Those procedures rely in a fundamental way on judgments made by the Postal Service about how the various categories of costs that it incurs change in response to changes in mail volume. These judgments form the basis for how the Postal Service assigns costs to specific products. However, Postal Service costing procedures also have clear implications for how costs should change over time. If these procedures are accurate, it should be the case that in response to historic declines in mail volumes, variable costs decline, while fixed costs remain fixed. One way to test these judgments is to assess whether the great "natural experiment" created by the events of the past several years has confirmed or contradicted the predictions implicit in the Postal Service's costing procedures.[41] If the Postal Service's cost models are inaccurate, this finding would call into question the Postal Service's compliance with PAEA.

A. TESTING THE POSTAL SERVICE'S COSTING ASSUMPTIONS

In this section I interpret the results of the natural experiment created by the events of the last several years, focusing on the category of costs that the Postal Service regards as fixed. To do this I first isolate the costs that, according to Postal Service costing procedures, should remain unaffected by volume changes. I then account for the effects that inflation has had on Postal Service costs. Finally, I relate the resulting inflation-adjusted fixed costs to a meaningful measure

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[41]   A natural experiment refers to an actual empirical study where the independent variable (here, mail volumes) has changed naturally (and not through some manipulation of the researcher). The independent variation in that variable thus permits the measurement of its effects on some dependent variable (here, Postal Service costs). Natural experiments play an important role in economic research, which usually occurs in a real-world setting.

of changes in volume that accounts not just for changes in piece counts, but also for changes in the mix of mail handled.

1.   Isolating Fixed Costs

Traditional Postal Service costing procedures collect operating costs by "segment," where a segment contains the costs associated with a set of related activities. Examples of segments include street activities of City Delivery Carriers (cost segment 7) or the costs of Postmasters (cost segment 1). The Postal Service divides its operating costs into 18 segments. These segments are further divided into a number of components. Thus, for example, within segment 14 – Purchased Transportation of Mail – there are components corresponding to expenditures for truck, rail, air and water transportation.

Within each segment and component the Postal Service has traditionally broken costs into three of the categories previously defined: volume variable costs, product-specific fixed costs, and institutional costs. In the traditional postal rate setting, institutional costs were treated largely as fixed costs. However, as discussed above, institutional costs actually include a large amount of inframarginal costs that do vary with changes in volume. To isolate costs that, according to Postal Service costing procedures, are supposed to be truly fixed, these inframarginal costs must be deducted from institutional costs.

Both the McBride paper and the Cohen/Waller paper referenced above calculated the Postal Service's fixed costs and discussed how they seem to have changed over time. McBride noted that many categories of supposedly fixed costs in fact declined over the period from 2007 through 2013 to a greater extent than overall volume. Cohen and Waller noted that while fixed costs generally declined over this period, they actually increased, according to their calculations, in 2011 and 2013.[42] They attributed the general decline in fixed costs to the Postal Service's "dramatic increases in productivity and cost cutting." They ascribe a large portion of the increase in fixed costs in 2011 and 2013 to decisions by the Postal Service to increase its spending on "Individual Awards," a category of spending that is treated as entirely fixed.

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[42]   Cohen, Robert and Waller, John, "The Postal Service Variability Ratio and Some Implications," page 19.

I have reviewed McBride's calculations of fixed costs, and I rely on McBride's methodology, using the programs contained within his workpapers to compute fixed costs for 2014.

2.   Accounting for the Effects of Inflation

To control for the effects of inflation on Postal Service costs I have constructed indexes tracking changes in various inputs to Postal Service operations, including labor, transportation, utilities, equipment, etc. I take particular care to capture accurately changes in labor costs, recognizing their enormous importance in the overall Postal Service cost structure. As of the end of its 2014 fiscal year the Postal Service employed approximately 618,000 workers (488,000 career employees and 130,000 non-career employees). Over the course of that same fiscal year the Postal Service incurred $51.5 Billion in labor costs ($46.0 Billion in compensation and benefits expense, $3.0 Billion in current retiree health benefits, and $2.5 Billion in worker's compensation), which in turn accounted for 76 percent of its total current operating expenses.[43] Clearly, labor is an important cost for the Postal Service, and so I account carefully for changes in the wages the Postal Service pays to its employees.

I was able to obtain from the Bureau of Labor Statistics detailed data describing the wages and salaries paid by the Postal Service.[44] This source provided annual data on average hourly wages by detailed occupational category.[45] The same source also provided data on number of employees by category. From this information I was able to calculate a Fisher Index of wages.[46] The resulting index captures the effects of wage level changes provided for in Postal Service labor agreements, as well as its recent increase in the use of lower cost part time and casual workers.

In addition to the wage index, I incorporated measures of non-wage inflation, using data from 19 producer price indices to reflect price changes affecting other categories of Postal Service

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[43]   All figures taken from Form 10-K, United States Postal Service, FY2014. I have excluded retiree health benefit prefunding (though not current premiums) from these figures.

[44]   See "National 3-Digit NAICS Industry-Specific estimates," available at
http://www.bls.gov/oes/oes_dl.htm

[45]   130 different occupational categories are represented in the data.

[46]   For a definition see
https://www.census.gov/construction/cpi/pdf/generalinformationaboutpriceindexes.pdf

expenses. These categories include transportation-focused indices, such as "truck transportation" and "air transportation", as well as rent, utilities, equipment, and financial indices to represent other overhead costs. I apply these indices within the various cost segments based on the proportion of associated costs in each segment. For instance, in Cost Segment 10 – Rural Carriers, I measure inflation using a weighted average of 3 inflation indices: the Fisher Index of Postal Service wages, the "private transportation" PPI, and the "equipment" PPI indexes, weighting by the percentage of overall cost in each category in that segment.[47] In this case, the wage index takes a weight of 91.99%, the private transportation index takes a weight of .04% of C/S 10 costs, and the equipment index takes a weight of 7.97%. I use this index to express C/S 10 fixed costs for the years 2008 through 2014 in constant 2014 dollars, and calculate analogous indices to make similar inflation adjustments for the other cost segments. [48]

3.   Weighted Mail Volume

The measure of work-content-weighted volume I use in this analysis is equal for each year to the summation across all postal products of the number of mail pieces handled in that year by the Postal Service multiplied by the per unit attributable costs in 2014 for that category of mail.

In constructing this measure, one of the realities that must be addressed is the periodic movement of products from the market dominant to the competitive categories. Figure 10 shows the movements that occurred over the period covered by my analysis.

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[47]   I calculate the weights from the line item expenditure information contained in USPS-FY14-5 Reconciliation to Financial Statements and Account Reallocations (Public) from ACR2014 which shows how the general ledger items are classified into segments and components. I classify each general ledger item into a cost category and select representative inflation indices for each classification.

[48]   In order to evaluate the extent to which the results reported here might be sensitive to the way in which I have adjusted for the effects of inflation I ran a series of tests using other measures of inflation. These included the substitution of a simple measure of labor costs per hour for the Fisher Index of occupation specific wages, the use of inflation indexes that ignored non-labor inputs and account only for changes in labor costs, and two general measure of inflation – the Consumer Price Index, and the GDP Deflator. Using each of these alternative measures of inflation, I reran all of the analyses reported in this section. The results for these tests differed somewhat in detail, but were broadly similar. In all cases I found that in a large majority of components inflation-adjusted "fixed" costs tended to move in step with changes in weighted volume.

Figure 10: Migration of Market Dominant Products to the Competitive Product Category
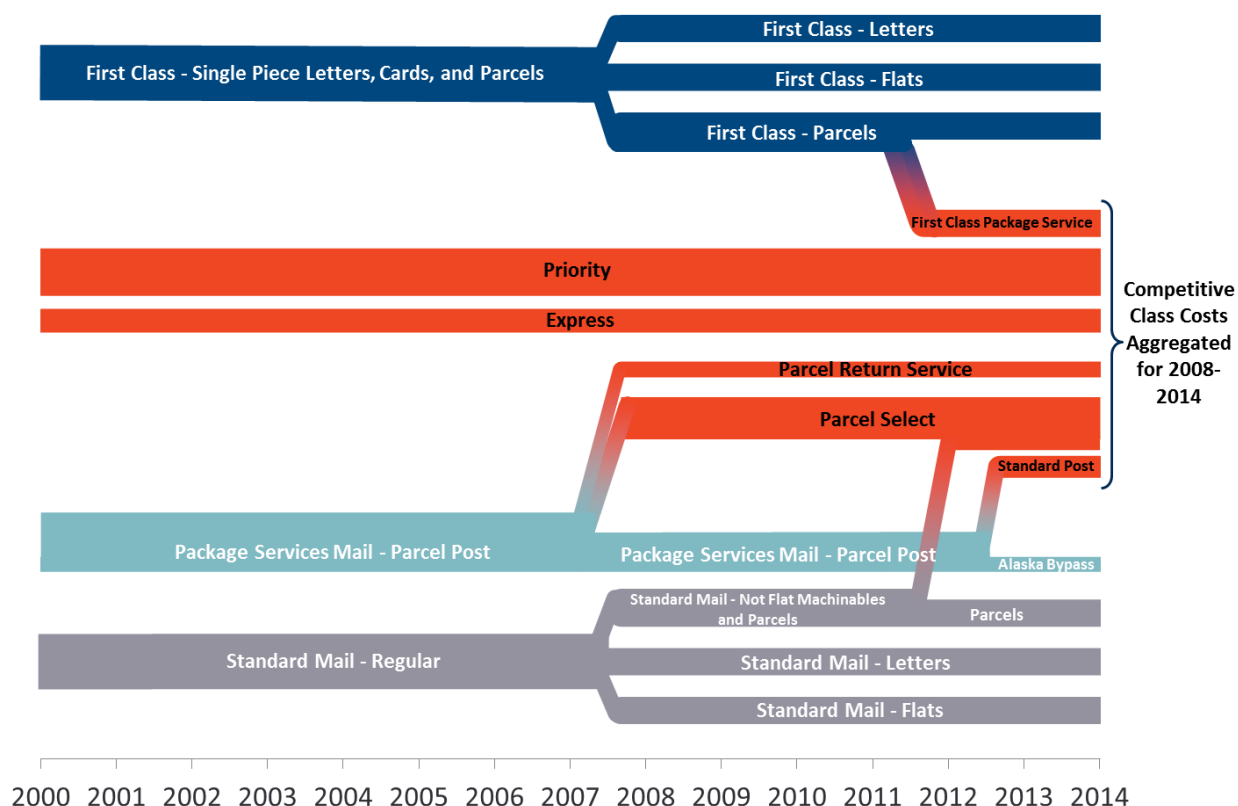
Inspection of RPW volume data confirms that when a portion of a market dominant product is split off and reclassified as competitive there is a visible drop in reported volume for the market dominant "parent" product.[49] In constructing my weighted volume measure I use whatever set of product definitions were in effect in each fiscal year. Thus when one of these competitive product transfers occurs there is generally a decline in the weighted volume of the "parent" product, and an offsetting increasing in the weighted volume associated with competitive products.

Table 7 shows the weighted volume and constant dollar fixed costs computed as described above for the fiscal years 2008 through 2014. In calculating fixed costs I have excluded cost segments

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[49]   The Postal Service releases annual Revenue, Pieces, and Weight reports that provide those totals by class of mail and special services for each fiscal year.

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18.3.4 (Workers Compensation) and 18.3.6 (Annuitant Health Benefits and Earned CSRS Pensions), two categories that have experienced large fluctuations in cost that are unrelated to the Postal Service's current operations. The weighted volume can be thought of as the attributable costs that would have been reported if 2014 volumes were replaced with volumes for the corresponding years. Note that total weighted volume declines steadily over the period. The weighted volume associated with competitive products initially declines slightly, then starts to increase. Inflation-adjusted fixed costs also initially decline, and then increase, mirroring the pattern seen for competitive products.

**Table 7: Weighted Volumes and Inflation Adjusted Postal Service Fixed Costs
Fiscal Years 2007 through 2014**

	Weighted Volume, Total [1]	Weighted Volume, Competitive [2]	Total Fixed Cost (Real $000), Excluding 18.3.4 and 18.3.6 [3]
2007	56,203,121	5,654,772	13,484,635
2008	52,060,350	5,677,062	12,628,615
2009	45,567,641	5,284,845	12,084,548
2010	43,195,491	5,419,359	11,686,251
2011	42,392,282	5,397,418	12,151,800
2012	40,775,798	7,104,311	11,863,451
2013	40,390,411	8,413,471	12,439,616
2014	39,530,333	9,215,289	12,072,517

Sources and Notes:

[1]: Sum over products of (reported piece count from RPW report) x (2014 unit attributable cost from Non-Public CSC).

[2]: Weighted volume for Express, Priority, First-Class Package Service, Parcel Return Service, Parcel Select, Standard Post, and Premium Forwarding Service.

[3]: USPS-reported "Other" cost excluding inframarginal cost as well as 18.3.4 - Workers Compensation and 18.3.6 - Annuitant Health Benefits & Earned CSRS Pensions.

4. Statistical Results

Table 8 reports the results of a simple linear regression of inflation-adjusted fixed costs on total weighted volume. Despite the limited number of observations, the overall regression and the individual coefficients are all statistically significant under standard tests.

Table 8: Regression Result on Weighted Volume

	Value	Standard Error	t-Stat	P-Value
Constant	8,871,956	997,946	8.8902	0.0001
Total Weighted Volume Coefficient	0.0762	0.0220	3.4634	0.0134
Number of Observations	8			
Adjusted R Square	0.6110			

These results show not just that the costs that the Postal Service regards as fixed are not actually fixed – a conclusion that can be drawn simply from inspection of the figures shown in Table 7 – but also that the changes in these costs closely track changes in volume – a finding reinforced by the high degree of statistical significance behind the result. Figure 11 shows visually the implications of these results, separating the variable costs hidden within supposedly "fixed" costs from the costs that are truly fixed.

It is not surprising to find that the costing procedures employed by the Postal Service do such a poor job of explaining recent cost trends. These costing procedures generally rely upon parameters drawn from infrequently updated econometric or engineering studies. Many appear to be seriously out of date. For example, the Postal Service is currently in the process of updating parameters for Cost Segment 7: City Delivery Carriers – Street Activity. However, many parameters used in other segments and even within Cost Segment 7 were last updated more than ten years ago. Even in the updated City Carrier study, most of the variability parameters used for Special Purpose Routes within Cost Segment 7 reference methodologies from 1997 and one even references 1987.[50] In FY14[51], the variability parameters used for Cost Segment 1: Postmasters

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[50] "Direct Testimony of Michael A. Nelson on Behalf of the United States Postal Service," Docket R97-1, USPS-T-19 and Docket R87-1, USPS-T-7.

[51] Based on FY14-NP14.

reference methodologies in 1984[52], for Cost Segment 3: Clerks and Mail handlers – Window Service reference 1997 and 2006[53], and for Cost Segment 10: Rural Carriers reference 1997 and 2000[54]. Given the antiquity of the analyses upon which they are based, it is hardly surprising that Postal Service costing procedures seem to do a poor job of explaining current cost relationships. However, there is a lot of variation across components in the relative "staleness" of the underlying studies, and this staleness alone does not account for the poor performance of Postal Service costing procedures.

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[52] Docket No. R84-1, USPS-T-12.

[53] "Direct Testimony of Christopher S. Brehm on Behalf of United States Postal Service," Docket No. R97-1, USPS-T-21. And "Direct Testimony of Michael D. Bradley on Behalf of United States Postal Service," Docket No. R2006-1, USPS-T-17.

[54] Docket No. R97-1, LR-H-33. And Docket No. R2000-1, USPS-RT-13.

Figure 11: Decomposition of Reported Fixed Costs
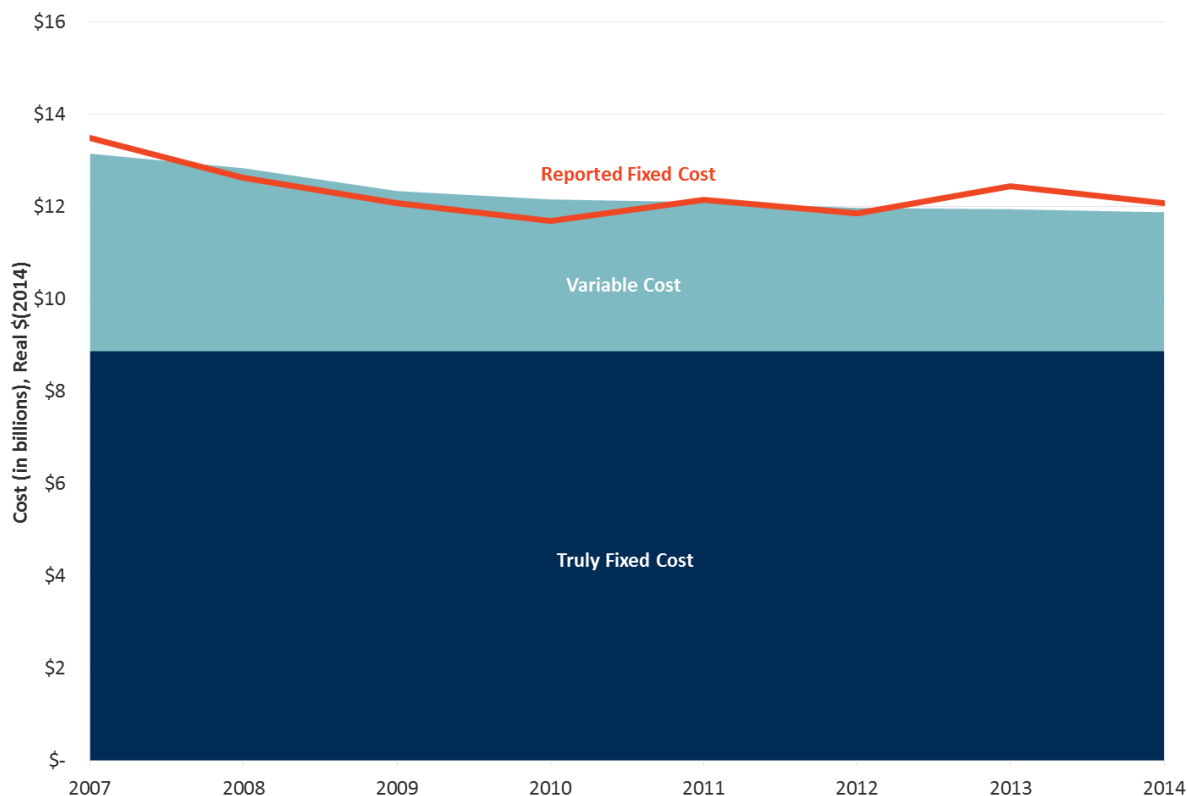
The significance and meaning of these results warrant detailed examination. Numerous Postal Service documents talk about the cost cutting initiatives and productivity improvements that the Postal Service has carried out over the years since the financial crisis. One might be tempted to explain falling "fixed" costs as a result of these initiatives. However, this explanation would not account for the increases in fixed cost that have occurred in recent years.[55] Nor would it explain how closely these costs track changes in volume. An alternative explanation is that the costs that

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[55] In their paper, Cohen and Waller identify four components that are partially responsible for the observed increase in total Postal Service fixed costs in FY2011 and FY2013. See "The Postal Service Variability Ratio and Some Implications," by Robert Cohen and John Waller, pp. 19-20. Nonetheless, there are still year-on-year increases in real fixed costs after subtracting any of those four individual component's fixed costs from the total. Furthermore, after subtracting the fixed costs in all four components they identify, total real fixed costs still increase in both FY2012 and FY2013.

are treated as fixed in Postal Service costing procedures actually contain large volumes of "hidden" variable costs.

B. COMPONENT LEVEL ANALYSIS

As a diagnostic exercise, the results presented above in Table 8 provide a compelling indication that, in the aggregate, Postal Service costs are not behaving as one would expect based on currently accepted costing procedures. In short, fixed costs do not in fact appear to be fixed. Rather, they exhibit a strong tendency to vary with changes in volume. However, while these results indicate the presence of a problem, they do not localize that problem. Nor do they indicate the nature of the corrective actions that may be called for. Development of actionable recommendations for correcting this problem requires more detailed insight into where these hidden variable costs are to be found.

To determine where current Postal Service costing procedures and parameters do not appropriately separate fixed and variable costs, I have replicated the statistical analysis of fixed costs discussed above, but at the component level.

1. Isolating Fixed Costs

At the component level I again divide costs into attributable, inframarginal, and fixed costs (institutional minus inframarginal costs), adjust fixed costs to remove the effects of inflation, and estimate component level regressions of these fixed costs on weighted volume. I use the attributable and institutional costs for each of the most granular components reported in the USPS CRA Model Public B Cost matrix, which is provided as a USPS library reference for ACR dockets. This source was also used by McBride in the paper discussed above. I also use the inframarginal costs calculated by McBride.[56] I account for inflation using the same methodology as described above.

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[56] I updated and reran McBride's code to calculate inframarginal costs for 2014. There are two new components in 2014 – 569 Rural Delivery and 424 Customer Care Centers – that are not addressed by McBride, and thus I conservatively assume that these have zero hidden variable costs.

2.   Component Level Weighted Mail Volume

To develop a measure of work-content-weight at the component level, I start with the 2014 per unit component level attributable costs for each of the mail classes.[57]   If a component is entirely fixed (i.e., attributable cost is zero for all mail classes), I use the 2014 per unit total attributable cost (summed across all components) for each mail class.   I multiply the number of mail pieces handled by the Postal Service for each mail class for each year (2007-2014) by these weights. I then sum across mail classes to get total weighted volume for each component for each year.

3.   Component Level Statistical Results: Univariate Regressions

I start by running simple linear regressions of inflation adjusted fixed costs on total weighted volume for the 85 components with some fixed costs. An initial review of these results strongly confirms the results shown above in Figure 11 and Table 8. Table 9 below shows the number of positive and negative coefficients on weighted volume produced by these regressions. If fixed costs were truly fixed, we would expect to see a random but relatively even split between component regressions with positive and negative coefficients on weighted volume. However, Table 9 shows that a large majority of component regressions indicate that Postal Service "fixed" costs vary directly with volume. The one-sidedness of these results is confirmed with a statistical test. We can use p to denote the probability of observing a positive slope coefficient; if fixed costs were fixed, we would expect p to equal 0.5. As can be seen in Table 9, 67 of the 84 estimated slopes were positive. A simple binomial test can be used to assess the likelihood of observing 67 or more positive slopes from 84 distinct regressions if the underlying probability p is 0.5. As Table 10 indicates, such a result is extremely unlikely, with a probability of effectively

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[57]   Mail classes included in this analysis are: Single Piece Letters, Single Piece Cards, Presort Letters, Presort Cards, First-Class Flats, First-Class Parcels, High Density and Saturation Letters, High Density and Saturation Flats and Parcels, Every Door Direct Mail Retail, Standard Mail Letters, Standard Mail Flats, Not Flat-Machinables and Parcels, In County Periodicals, Outside County Periodicals, Parcel Post / Alaska Bypass, Parcels, Bound Printed Matter Flats, Bound Printed Matter Parcels, Media and Library Mail, U.S. Postal Service, Free Mail, Certified, COD, Insurance, Registered Mail, Carrier Route, Money Orders, Other Ancillary Services, Priority Mail Express, Priority Mail, First-Class Package Service, Parcel Return Service Mail, Parcel Select Mail, Standard Post, and Premium Forwarding Service.

zero.[58]   The likely explanation for these results is that there is systematic bias that tends to overstate the fixed costs of the Postal Service. The additional "hidden" variable costs implied by these regressions would be equal to weighted volume times the coefficient on weighted volume times the appropriate inflation index (to convert them back to current dollars).

Table 9: Component Level Regression Results

		Coefficient on Constant		
		Positive	Negative	Total
Coefficients on Weighted Volume	Positive and Significant Slope	6	31	37
	Positive and Insignificant Slope	20	10	30
	Positive Slope Total	26	41	67
	Negative Slope	17	0	17
	Total	43	41	84

Notes:

Regressions were modeled on all components for which OTHER COSTS reported in the USPS CRA Model Public B Cost Matrix less estimated Inframarginal Costs were greater than zero for all years between 2007 and 2014 except for Domestic Alaska Air.

Results represent regressions of real fixed cost per component on weighted volume with a constant.

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[58]   I have also carried out an alternative statistical test which evaluates the average t-stat associated with the slope coefficient from each of the 84 regressions. If costs were truly fixed, one would expect the average t-stat to be 0; it is in fact 3.17, which is statistically different from zero with a p-value of 8.50 x 10^{-8}.

Table 10: Statistical Test of Pattern of Regression Coefficients

N [1]	Assumed p [2]	Expected k [3]	Observed k [4]	Observed p [5]
84	0.5	42	67	0.7976
Probability of observing $k >= 68$:			[A]	1.75×10^{-8}

Notes and Sources
[1]: Number of distinct slope coefficients being evaluated.
[2]: Probability of observing positive slope for a given
   coefficient, if costs are truly fixed.
[3]: [1] x [2]
[4]: Actual number of observed coefficients with positive slope.
[5]: [4] / [1]
[A]: P-value from a one-sided binomial test with $k = 67$, $N = 84$,
   and $p = 0.5$

There are a few components where I accept Postal Service costing procedures and the resulting fixed costs. In particular, I accept Postal Service costing for components when the regression results in a negative coefficient on weighted volume. Taken on its face, this result would imply that adding mail to the system reduces fixed cost – a result that I find a priori to be implausible. [59] Similarly, there are some components for which the regression yields a negative and insignificant constant and a positive but insignificant coefficient on weighted volume. In such cases, I concluded that there was insufficient evidence to reject Postal Service costing procedures. [60] I also accept Postal Service costing when the reported institutional costs are negative, when fixed

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[59] All regression analysis is done in the presence of some statistical noise, which can occasionally generate some surprising results. If the true coefficient is 0 (which should be the case when costs are fixed), the presence of statistical noise should generate roughly an equal number of positive and negative coefficients. However, the estimated coefficients are overwhelmingly positive; this is the case nearly 80% of the time. The fact that there are occasionally negative coefficients in the regressions I have run is thus not alarming. Accordingly, in these components, I accept the Postal Service costing that the fixed costs are in fact fixed.

[60] For components where the initial regression yielded a negative constant but had a positive and significant slope coefficient, I did not accept Postal Service costing, as described in the following subsection.

costs for the component are equal to zero, for component 681 – Domestic Alaska Air[61], if there are no reported fixed costs for a component for any year over the time period, or if the component is new in FY14 and thus has no historical costs to analyze. As shown in Table 9, there are 17 components with negative coefficients on weighted volume and 10 components with negative constants and positive but insignificant slopes. There are an additional 86 components, out of a total of 170, that meet one of the criteria described.

4.   Component Level Statistical Results: Regressions without Constants

In the next step of my analysis, I reexamine the 31 components whose regressions result in positive and statistically significant coefficients on weighted volume but negative constant terms. The constant term of the regression is the predicted "truly" fixed cost for that component. Thus, a negative term is not conceptually plausible. For these components I run a second regression analysis of inflation adjusted fixed costs on total weighted volume but set the constant term equal to zero. Relative to the regression with constant, this implies zero fixed cost (as opposed to a negative fixed cost) and fewer hidden variable costs. Figure 12 depicts the decision tree I used in determining which regression results to use in evaluating each component's fixed costs.

Figure 12: Component Fixed Cost Regressions Decision Tree

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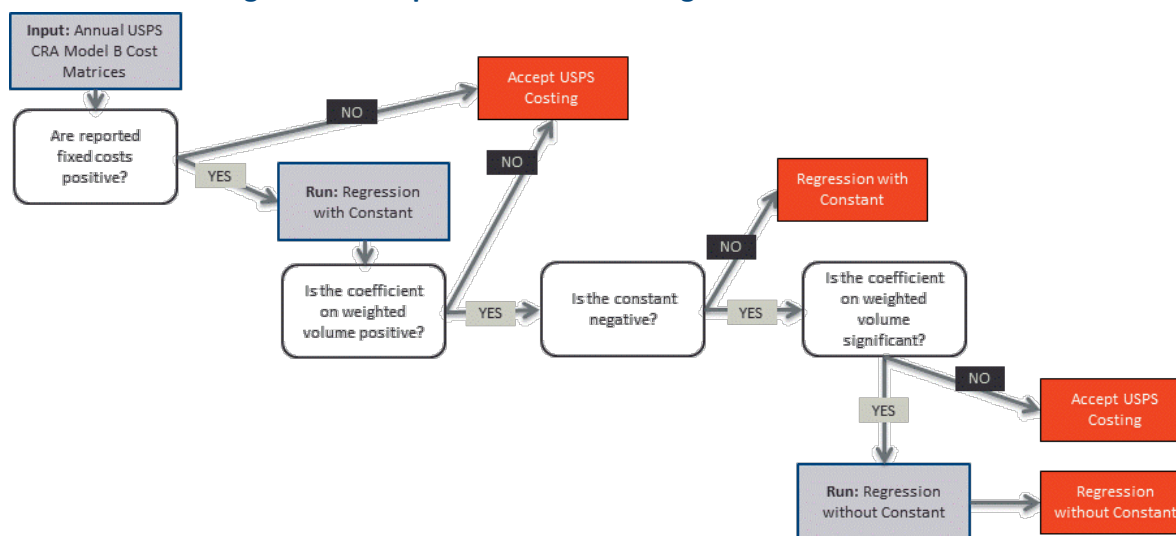
[61]   Domestic Alaska Air has been excluded because the additional costs incurred in providing mail service in Alaska have been regarded as part of the Postal Service's universal service obligation, regardless of their variability.

5.   Component Level Statistical Results: Summary

Using the results of these regressions, I estimate the potential overstatement of fixed costs. Table 11 shows the regression types I use to estimate the overstatement, how many components fit in each category, the 2014 institutional costs for these components and the 2014 total costs for these components.

Table 11: Component Regression Summary

Category Description			Component Count [1]	2014 Attributable Costs ($ M) [2]	2014 Inframarginal Costs ($ M) [3]	2014 Fixed Costs ($ M) [4]	2014 Total Cost ($ M) [5]
Regression with Constant	[A]	Significant Slope	6	1,914	-	2,722	4,636
		Insignificant Slope	20	2,503	215	3,957	6,675
Regression without Constant	[B]	Significant Slope	31	3,403	158	1,308	4,869
Negative Constant with Insignificant Slope	[C]		10	74	-	134	208
Negative Slope	[D]		17	4,505	271	12,151	16,926
Not Modeled	[E]		86	27,132	12,762	154	40,048
Total	[F]		170	39,530	13,406	20,426	73,362

Notes and Sources:

[1]: Components are the most granular components in the 2014 ACR USPS CRA Model Public B Cost Matrix.

[2]: TOTAL ATTRIBUTABLE COSTS as reported in the USPS CRA Model Public B Cost Matrix, differences due to rounding.

[3]: Inframarginal Costs calculated following McBride's methodology applied to 2014.

[4]: OTHER COSTS as reported in the USPS CRA Model Public B Cost Matrix less [3], differences due to rounding.

[5]: TOTAL COSTS as reported in the USPS CRA Model Public B Cost Matrix, differences due to rounding.

[A]: Components for which fixed cost regression resulted in a positive slope coefficient and constant.

[B]: Components for which fixed cost regression resulted in a positive slope coefficient and negative constant. Regressions were re-estimated to exclude the constant.

[C]: Components for which fixed cost regression resulted in a positive, insignficiant slope coefficient and a negative constant.

[D]: Components for which fixed cost regression resulted in a negative slope coefficient.

[E]: Domestic Alaska Air and other components that were not modeled because OTHER COSTS reported in the USPS CRA Model Public B Cost Matrix were less than or equal to zero for any year between 2007 - 2014.

[F]: [A] + [B] + [C] + [D] + [E].

The Postal Service might argue that the regression analyses underlying these results are based upon an overly simplistic model that does not take into account the different factors that might

influence postal operations and postal costs. However, these arguments do not apply to the results discussed above. The costs that form the dependent variables in these regressions are the costs remaining after the effects of all other costs drivers have, at least according to the Postal Service, been appropriately taken into account. These are supposed to be fixed costs, and so there is not supposed to be any other source of variation left to be taken into account.

6. In Which Cost Segments Are Fixed Costs Being Classified Incorrectly, and What Should Be Done About It?

Above I report the results of a series of straightforward statistical analyses that provide compelling evidence that a significant portion of the costs that current Postal Service costing procedures regard as fixed in fact vary with changes in mail volume. In this section I distill these results into a set of specific recommendations for the Commission.

The results presented above identify a number of problems that can be easily solved. In components that are currently treated as entirely fixed by the Postal Serviced there is no "incumbent" costing model to be updated. In such cases, when a straightforward statistical analysis of the type reported above identifies a statistically significant relationship between "fixed" cost and mail volume, I recommend that the Commission accept the results of the statistical analysis and attribute the "hidden" variable costs to individual products based on their respective shares of overall attributable costs in the preceding fiscal year. In Table 12 I identify the components that meet these criteria.

Table 12: Entirely Fixed Components for which Variability Results should be Accepted

Cost Segment Name	Component	Component Name	Reported Fixed Cost	Hidden Variable Cost	Truly Fixed Cost
			(2014 costs, in thousands)		
[1]	[2]	[3]	[4]	[5]	[6]
C/S 2 Supervisors and Technicians	18	Network Travel	$ 67,326	$ 67,326	$ -
C/S 7 City Delivery Carriers – Street Activity	53	Network Travel Support	$ 191,560	$ 70,831	$ 120,729
C/S 12 Motor Vehicle Service	86	City Delivery Network Travel	$ 181,169	$ 113,400	$ 67,769
C/S 12 Motor Vehicle Service	89	Other Personnel	$ 15,038	$ 14,809	$ 229
C/S 13 Miscellaneous Local Operations	114	Other Local Operations	$ 31,245	$ 31,245	$ -
C/S 13 Miscellaneous Local Operations	125	Fed. Reserve & Commercial Bank Services	$ 12,710	$ 12,710	$ -
C/S 13 Miscellaneous Local Operations	131	City Delivery Network Travel	$ 258	$ 253	$ 5
C/S 13 Miscellaneous Local Operations	134	Other Carfare	$ 8,803	$ 8,803	$ -
C/S 13 Miscellaneous Local Operations	140	City Delivery Network Travel	$ 526	$ 511	$ 15
C/S 15 Building Occupancy	169	Building Projects Expense	$ 185,991	$ 179,566	$ 6,424
C/S 16 Supplies and Services	175	Repair Equip. Supplies & Services Excl. ADP	$ 1,513	$ 1,513	$ -
C/S 16 Supplies and Services	179	Printing & Reproduction	$ 14,208	$ 14,208	$ -
C/S 18 Administration and Area Operations	193	Area Administration	$ 104,853	$ 104,853	$ -
C/S 19 General Management Systems	219	Maintenance Technical Support Center	$ 3,963	$ 3,963	$ -
C/S 20 Other Accrued Expenses (Servicewide)	225	City Delivery Network Travel	$ 33,610	$ 33,610	$ -
		TOTAL:	$ 852,773	$ 657,600	$ 195,173

Sources and Notes:

[1]-[3]: Components are selected based on the following criteria:

a) OTHER COSTS reported in the USPS CRA Model Public B Cost Matrix were greater than zero for all years between 2007 - 2014.

b) Component is entirely fixed with no domestic attributable costs.

b) Slope coefficient is significant at the 5% level.

[4]: OTHER COSTS reported in the USPS CRA Model Public B Cost Matrix.

[5]: (Weighted Volume in 2014) x (Slope coefficient of regression).

[6]: [4] - [5].

My statistical analysis of "fixed" costs also identified significant amounts of "hidden" variable costs in a number of components that under current Postal Service costing procedures are supposed to contain a mixture of fixed and attributable costs. In these components there is an "incumbent" costing model, but that model appears to be producing incorrect answers. In this context I adopt $100 million as the threshold for defining what constitutes a significant amount of hidden variable costs. Table 13 identifies the components that meet these criteria. The Postal Service should attribute a component's hidden variable costs in proportion to the attribution implied by the legacy model unless and until further study suggests otherwise. I urge the Commission to require the Postal Service either to update its costing procedures or to produce current evidence supporting their ongoing use.

Table 13: Components for which Costing should be Re-examined

Cost Segment Name	Component	Component Name	Reported Attributable Cost	Reported Fixed Cost	Hidden Variable Cost	Truly Fixed Cost
[1]	[2]	[3]	*(2014 costs, in thousands)* [4]	[5]	[6]	[7]
C/S 2 Supervisors and Technicians	33	Product Specific and Other S & T	$ 31	$ 419,847	$ 419,847	$ -
C/S 6 City Delivery Carriers – Office Activity	43	In-Office Direct Labor	$ 2,197,540	$ 168,216	$ 168,216	$ -
C/S 10 Rural Carriers	70	Other Routes	$ 141,092	$ 290,374	$ 208,289	$ 82,085
C/S 18 Administration and Area Operations	195	Inspection Service Field Support	$ 13	$ 493,113	$ 136,341	$ 356,772
C/S 18 Administration and Area Operations	202	Annuitant Health Benefits - Earned (Current)	$ 1,772,889	$ 1,380,147	$ 1,380,147	$ -
		TOTAL:	**$ 4,111,565**	**$ 2,751,697**	**$ 2,312,840**	**$ 438,857**

Sources and Notes:

[1]-[3]: Components are selected based on the following criteria:

a) OTHER COSTS reported in the USPS CRA Model Public B Cost Matrix less estimated Inframarginal Costs were greater than zero for all years between 2007 - 2014. Excludes Domestic Alaska Air.

b) Hidden variable cost is estimated as greater than $100 million in 2014.

c) Slope coefficient is significant at the 5% level.

[4]: Attributable cost reported by USPS in 2014.

[5]: OTHER COSTS reported in the USPS CRA Model Public B Cost Matrix less estimated Inframarginal Costs in 2014.

[6]: (Weighted Volume in 2014) x (Slope coefficient of regression).

[7]: [5] - [6].

My fixed cost analysis identified a large volume of "hidden" variable costs that does not appear in either Table 12 or Table 13. The components within which these costs are found are listed in Table 14. As I noted above, even though many of the regression coefficients for those components presented in Table 14 do not meet the usual tests for statistical significance, the fact that such a large majority of them suggest a positive relationship between volume and fixed cost levels is itself significant – a suggestion that was overwhelmingly confirmed by the results of the informal test presented in Table 10. These results suggest the existence of a systematic tendency to overstate fixed costs. However, in my view the best way to address this tendency in the absence of further analysis is, as I discuss below, through the process whereby the share of institutional costs that must be covered by competitive products is set.

Table 14: Additional Components

Cost Segment Name	Component	Component Name	Reported Attributable Cost	Reported Fixed Cost	Hidden Variable Cost	Truly Fixed Cost
[1]	[2]	[3]	*(2014 costs, in thousands)* [4]	[5]	[6]	[7]
Significant Coefficients						
C/S 2 Supervisors and Technicians	9	Supervision of Admin. and Support Activities [\A\	$ 11,543	$ 8,707	$ 8,707	$ -
C/S 2 Supervisors and Technicians	13	Office	$ 144,978	$ 26,119	$ 26,119	$ -
C/S 2 Supervisors and Technicians	17	Street Other	$ 23,391	$ 9,217	$ 9,217	$ -
C/S 2 Supervisors and Technicians	601	Supervisor Training	$ 7,951	$ 3,013	$ 3,013	$ -
C/S 2 Supervisors and Technicians	674	Rural Delivery Carriers	$ 16,502	$ 28,699	$ 28,699	$ -
C/S 3 Clerks and Mailhandlers – CAG A-J Offices	41	Other	$ 24,946	$ 23,199	$ 23,199	$ -
C/S 3 Clerks and Mailhandlers – CAG A-J Offices	66	Claims & Inquiry	$ 1,030	$ 10,133	$ 8,311	$ 1,822
C/S 3 Clerks and Mailhandlers – CAG A-J Offices	228	Time & Attendance [\A\ report]	$ 4,585	$ 3,458	$ 3,458	$ -
C/S 3 Clerks and Mailhandlers – CAG A-J Offices	422	General Office & Clerical	$ 307,258	$ 90,957	$ 86,618	$ 4,339
C/S 3 Clerks and Mailhandlers – CAG A-J Offices	470	Training	$ 55,329	$ 170	$ 170	$ -
C/S 6 City Delivery Carriers – Office Activity	44	In-Office Support Overhead	$ 490,148	$ 37,520	$ 37,520	$ -
C/S 12 Motor Vehicle Service	100	City Delivery Office	$ 2,309	$ 416	$ 336	$ 80
C/S 13 Miscellaneous Local Operations	127	City Delivery Office	$ 352	$ 64	$ 64	$ -
C/S 13 Miscellaneous Local Operations	136	City Delivery Office	$ 719	$ 129	$ 129	$ -
C/S 15 Building Occupancy	168	Communications	$ 355	$ 85,524	$ 81,054	$ 4,470
C/S 16 Supplies and Services	246	Advertising	$ 114,329	$ 60,763	$ 49,154	$ 11,609
C/S 20 Other Accrued Expenses (Servicewide)	1437	Other Interest	$ 1	$ 37,587	$ 37,587	$ -
Significant Coefficient Total:			**$ 1,205,725**	**$ 425,675**	**$ 403,355**	**$ 22,320**
Insignificant Coefficients						
C/S 1 Postmasters	2	Postmasters EAS 24 & Above	$ -	$ 53,144	$ 8,881	$ 44,263
C/S 7 City Delivery Carriers – Street Activity	54	Network Travel	$ -	$ 1,399,295	$ 248,844	$ 1,150,450
C/S 10 Rural Carriers	73	Equipment Maintenance Allowance	$ -	$ 556,297	$ 11,704	$ 544,593
C/S 12 Motor Vehicle Service	95	City Delivery Network Travel	$ -	$ 383,937	$ 12,506	$ 371,431
C/S 12 Motor Vehicle Service	98	Other Supplies & Materials	$ -	$ 38,015	$ 15,219	$ 22,796
C/S 13 Miscellaneous Local Operations	111	Contract Stations	$ -	$ 74,095	$ 19,388	$ 54,707
C/S 13 Miscellaneous Local Operations	112	CAG L Rental Allowance	$ -	$ 1	$ 1	$ -
C/S 14 Transportation	142	Domestic Air	$ 1,926,514	$ 33,936	$ 10,062	$ 23,874
C/S 16 Supplies and Services	173	Supply Personnel	$ -	$ 10,802	$ 109	$ 10,693
C/S 16 Supplies and Services	177	Miscellaneous Postal Supplies & Services	$ 470,645	$ 158,662	$ 68,812	$ 89,850
C/S 16 Supplies and Services	1426	Non-Mail Related Products	$ -	$ 19,987	$ 4,646	$ 15,341
C/S 17 Research and Development	190	Research & Development	$ -	$ 20,184	$ 7,339	$ 12,846
C/S 18 Administration and Area Operations	191	Headquarters	$ 10,891	$ 742,715	$ 140,581	$ 602,134
C/S 18 Administration and Area Operations	199	Repriced Annual Leave [\A\ report]	$ 49,267	$ 39,895	$ 8,186	$ 31,709
C/S 18 Administration and Area Operations	210	Supplies & Services	$ 45,323	$ 203,735	$ 82,778	$ 120,956
C/S 18 Administration and Area Operations	241	Unemployment Compensation [\A\ report]	$ -	$ 13,159	$ 13,159	$ -
C/S 19 General Management Systems	220	Supplies & Services	$ 8	$ 19,733	$ 19,733	$ -
C/S 20 Other Accrued Expenses (Servicewide)	230	Other	$ -	$ 12,066	$ 12,066	$ -
C/S 20 Other Accrued Expenses (Servicewide)	242	Insurance Claim Write-offs	$ -	$ 98,163	$ 25,777	$ 72,386
C/S 20 Other Accrued Expenses (Servicewide)	245	Other Expenses	$ -	$ 79,126	$ 2,349	$ 76,777
Insignificant Coefficient Total:			**$ 2,502,649**	**$ 3,956,948**	**$ 712,141**	**$ 3,244,806**
GRAND TOTAL:			**$ 3,708,374**	**$ 4,382,622**	**$ 1,115,496**	**$ 3,267,126**

Sources and Notes:

[1]-[3]: Remaining components modeled in regression analysis.

[4]: Attributable cost reported by USPS in 2014.

[5]: OTHER COSTS reported in the USPS CRA Model Public B Cost Matrix less estimated Inframarginal Costs in 2014.

[6]: (Weighted Volume in 2014) x (Slope coefficient of regression).

[7]: [5] - [6].

Attributing the hidden variable costs identified, though limiting the impact to those components with significant slope coefficients, increases attributable costs by roughly 9%.[62] The impact varies by product, as each component for which hidden variable costs have been identified relies on a different distribution key, which I have used as the basis for distributing these costs. Table 15 provides a summary of the impact for major groups of products, as well as product-level detail for domestic competitive products.

Table 15: Proposal Two Cost Impact w/ Domestic Competitive Detail (FY14 $ Millions)

Mail Class	Current Methodology	Hidden Variable	Proposal Two	% of Current Costs
[1]	[2]	[3]	[4]	[5]
Total Market Dominant (MD) Attributable Costs	**28,205**	**2,649**	**30,854**	**109%**
Priority Mail Express	366	30	395	108%
First-Class Package Service	1,155	97	1,252	108%
Priority Mail	5,234	380	5,615	107%
Ground	2,472	217	2,689	109%
Competitive International	1,385	-	1,385	100%
Domestic Competitive Services	359	1	359	100%
Total Competitive (CP) Attributable Costs	**10,970**	**725**	**11,695**	**107%**
TOTAL ATTRIBUTABLE COSTS	**39,175**	**3,374**	**42,549**	**109%**
OTHER COSTS	34,187	(3,374)	30,813	90%
TOTAL COSTS	73,362		73,362	

Notes and Sources:

[1], [2]: Mail classes as reported in the FY14 Public Cost and Revenue Analysis (PCRA). Note that these costs differ from Component 460 in FY14 CRA Cost Model B (CRA B).

[3]: Hidden Variable Costs are predicted costs from significant fixed cost regressions and distributed amongst classes used in the fixed cost regressions.

[4]: [2] + [3].

[5]: [4] / [2].

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[62] Note that this analysis presents only the impact of Proposal Two. However, the dollar impact of Proposal Two (column [4] in Table 15) should not, a priori, depend on whether or not the Commission also accepts Proposals One or Three.

C.   CONCLUSIONS

In crafting my recommendations, I have focused on components in which there is statistically significant evidence of the presence of hidden variable costs. However, I urge the Commission to consider the broader implications of the findings presented here. The results presented above provide evidence of a broad and systematic tendency for current Postal Service costing procedures to understate the volume variability of costs. The results presented in Table 12 through Table 14 further suggest that this tendency may be particularly pronounced in components that might be characterized as "overhead" – headquarters, administration supervision, building costs, etc.

I am not surprised by these findings. Over the course of a long career I have had the opportunity to analyze the cost structures of many different organizations in both the public and private sectors. From this experience I have come to conclude that almost all costs are variable to some degree, and that the challenge often is how to measure reliably the degree of this variation. Many organizations – including those sincerely interested in and committed to understanding their cost structures – struggle with this problem, especially in connection with administrative and overhead activities. I have often found that management underestimates the extent to which overhead costs vary with changes in output. In this regard, the Postal Service appears to have a lot of company.

IV.   Appropriate Share: What Share of Fixed Costs Should Be Covered by Competitive Products?

One of the provisions of PAEA is the requirement that competitive products cover an appropriate share of the institutional costs of the Postal Service. In this section I consider the question of how to determine the share of institutional costs that it is "appropriate" for competitive products to cover, focusing on economic tools and business practices that can provide useful guidance. I consider how this question would be viewed, analyzed and resolved within a private multiproduct firm. I also consider the appropriate share question in light of the fixed cost analysis in the previous section and consider the relevance of a precedent from the European Union.

In considering this question it is helpful to begin by considering how the roles of market dominant and competitive products have changed in recent years. Figure 12 and Table 16 show the total revenues earned by the Postal Service over the period from 2008 through 2014.[63] Over this period, total revenues fell by $7.1 billion, or 9.5 percent. This decline in revenue was concentrated in market dominant products. Over the same period, the revenues generated by competitive products, in contrast, increased significantly, rising from $8.4 billion to $15.4 billion.[64]

Figure 13: Postal Service Revenue, by Product Category
2008-2014
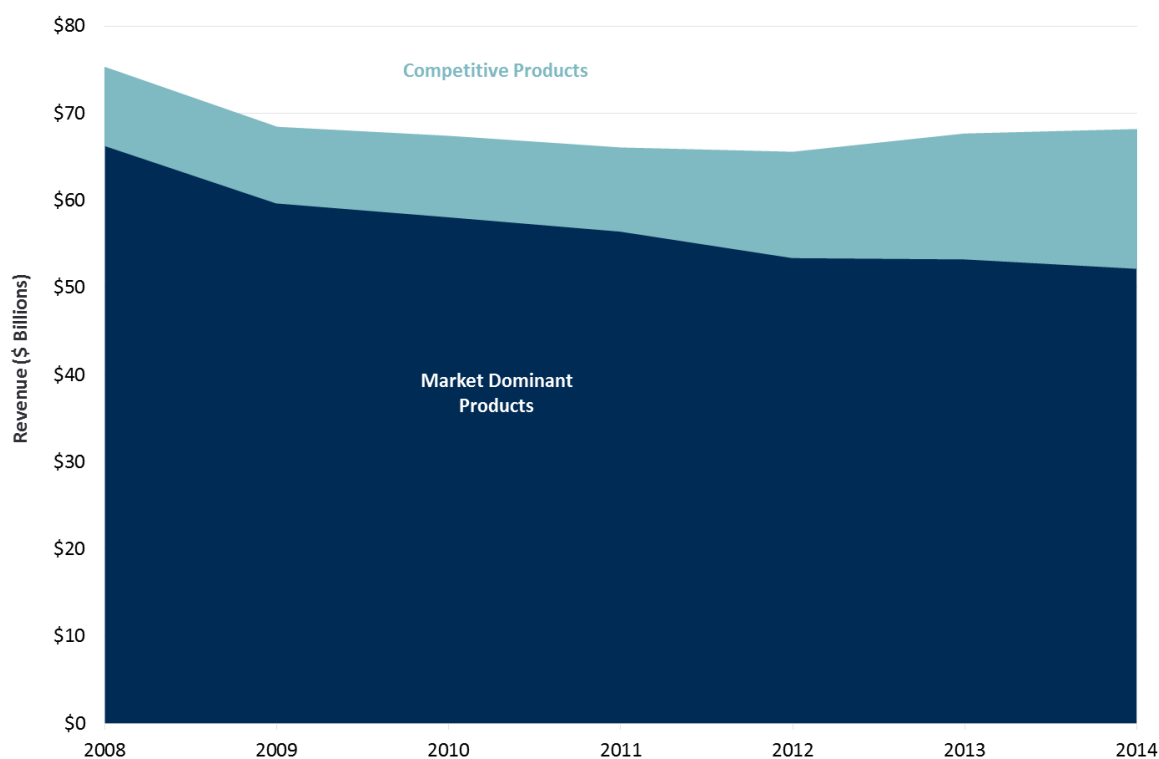
Source: Fiscal Year Revenue, Pieces, and Weight Reports

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[63]   Figure 12 and Table 16 are the same as Figure 1 and Table 1, reproduced here for convenience.

[64]   This growth has been fueled in part by a reclassification of some products from the market dominant category to the competitive category. However, regardless of the reasons for this growth, it is clear that the importance of competitive products has grown substantially since the passage of PAEA.

Table 16: Postal Service Revenue, by Product Category
2008-2014 ($ Millions)

		2008	2009	2010	2011	2012	2013	2014
Market Dominant Products	[A]	66,587	59,984	58,395	56,745	53,715	53,565	52,488
Competitive Products	[B]	8,382	8,132	8,682	8,994	11,532	13,776	15,367
Total	[C]	74,968	68,116	67,077	65,739	65,247	67,342	67,854

Notes and Sources:

Revenues from Fiscal Year Revenue, Pieces, and Weight Reports. Classification of products as market dominant or competitive reflects the classification in effect in each individual year.

[A]: Market Dominant includes Market Dominant Mail and Services and Other Market Dominant Revenue.

[B]: Competitive Products include Domestic Competitive Mail and Services and International Competitive Mail and Services.

[C]: [A] + [B].

Currently competitive products are required to cover only 5.5 percent of institutional costs. This fraction clearly fails to reflect their current importance to the Postal Service, the amount of attention they command from Postal Service management, and the share of attributable costs for which they account.[65]

A.   COST ALLOCATION IN A PRIVATE FOR-PROFIT MULTIPRODUCT FIRM

How would a private for-profit multiproduct firm approach and answer the question of how responsibility for coverage of fixed costs should be assigned to individual products? To answer this question I examine private sector practice relating to treatment of overhead costs. Costs that the Postal Service classifies as fixed costs are often referred to as "overhead costs" within the private sector. Both terms refer to indirect costs, which are costs that are not directly accountable to products.

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[65]   In FY2014, competitive products accounted for 28.0% of attributable costs. Source: Public Cost and Revenue Analysis for FY2014.

In the private sector, overhead costs are generally allocated to individual products on some sort of proportional basis.[66] The practice of allocating overhead costs to individual products in this way is so widespread within the private sector as to be nearly universal.[67] It is both reasonable and informative to ask why private businesses are so fully committed to a practice that the Postal Service avoids so assiduously.

The language that private businesses use when allocating fixed or overhead costs to products says a lot about why they do it. It is common for private businesses to talk about "assigning" fixed or overhead cost to products, or about "building fixed or overhead costs into rates and prices." Such language reflects an intention to assign to each individual product or service some degree of responsibility for generating enough contribution to assure that adequate revenues will be available to cover these costs. Such allocations of fixed costs amount, in effect, to establishment of a plan for making sure that collectively all products generate enough revenue and contribution to assure that all of the organization's fixed costs are covered.

Private businesses typically pay careful attention to the problem of making sure they are bringing in enough contribution to cover fixed costs. If those costs are not covered, the lights go out and the business shuts down. For the most part, private businesses do not have access to a protected stream of monopoly revenue they can count on to cover fixed costs. Neither can they take out loans from the Treasury at below-market rates, nor generally expect government intervention if they encounter difficulties in covering fixed costs.

In contrast, the Postal Service has traditionally had a very different view of this problem. For much of its history the revenues generated by its letter mail monopoly were more than sufficient to cover fixed costs. Disagreements could and did arise regarding the fraction of those costs users of monopoly services should pay. But how much they could or would pay was, for most of the Postal Service's history, not a constraining factor.

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[66] See, for example Zimmerman, Jerold L. "Accounting for Decision Making and Control," 7th Edition, p. 48: "By definition, overhead costs cannot be directly traced to products. Instead, they must be allocated to products. The most common allocation bases are direct labor hours, direct material, machine hours, and direct labor dollars."

[67] See Zimmerman, p. 304: "Most U.S. corporations allocate a significant amount of corporate overhead back to their profit centers."

This situation has clearly changed, however. In recent years the Postal Service has had difficulty generating enough contribution from market dominant products over and above their attributable costs to cover its institutional, or fixed, costs. The Postal Service has also recently hit its debt limit.[68] We have clearly arrived at a point where the Postal Service needs to start focusing on and planning for how these costs are to be covered, just as private firms routinely do.

B. SOFT COST CAUSATION AND ITS RELEVANCE TO RESPONSIBILITY FOR FIXED COSTS

A second reason for the widespread private sector practice of allocating fixed or overhead costs to individual products stems from recognition of the importance of "soft" cost causation. Private firms are accustomed to calculating with great rigor the costs of producing the products and services they sell. In addition to these direct costs, however, firms will always incur other costs – often referred to as sales, general and administrative – that are related to their scale of operations in ways that are difficult to measure with precision. Most private businesses realize that if they were to double their sales, they would probably have to expand their headquarters and support functions, at least to some degree. Allocation of these indirect costs on some proportional basis provides a way of accounting for the fact that these costs are likely to expand as a result of growth in sales.

As the analysis supporting Proposal Two described above indicates, this same pattern of cost causation is widespread within the Postal Service. Many of the administrative costs that the Postal Service has traditionally regarded as fixed do seem to vary to a significant extent with variations in volume.[69] This tendency is borne out not only by a large number of significant and positive coefficients but also by the fact that the overwhelming majority of the estimated coefficients turns out to be positive, a result that cannot be ascribed to mere chance. Thus, while my conclusions in the previous section are to attribute that portion of costs that are currently classified as fixed but that I have shown to be variable, the findings in that section also provide strong support for the argument that even those costs for which the relationship is less strong will tend to vary with weighted volume (and thus should be attributed). Accordingly, it is

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[68] See, for example, http://money.cnn.com/2012/10/17/news/usps-debt-limit/

[69] Examples include Employee Awards, Building Project Expense and Area Administration.

entirely appropriate for the Commission to require allocation of indirect costs that is based not on the arbitrary and dated number of 5.5% but that is instead linked to the growing relative importance of the competitive products division with the Postal Service. This step would address the Postal Service's apparent tendency to overstate fixed costs, and prevent the possibility that competitive products benefit from market dominant products without contributing appropriately to the costs of the larger network upon which both sets of products depend.

C.   A POSTAL PRECEDENT FROM THE EUROPEAN UNION

Finally, a third argument in support of allocating responsibility for common costs in a manner that is more in line with products' share of directly attributable costs comes in the form of precedent from the European Union. Specifically, the European Union established in 1997 and amended in 2006 a directive concerning the accomplishment of the internal market of European Community postal services. Article 14 pertains to cost accounting and to the division of costs between services necessary to fulfill each member postal service's universal service obligation and those services that are not. It directs common costs to be allocated as follows:

> "(i) whenever possible, common costs shall be allocated on the basis of direct analysis of the origin of the costs themselves;
>
> (ii) when direct analysis is not possible, common cost categories shall be allocated on the basis of an indirect linkage to another cost category or group of cost categories for which a direct assignment or allocation is possible; the indirect linkage shall be based on comparable cost structures;
>
> (iii) when neither direct nor indirect measures of cost allocation can be found, the cost category shall be allocated on the basis of a general allocator computed by using the ratio of all expenses directly or indirectly assigned or allocated, on the one hand, to each of the universal services and, on the other hand, to the other services."[70]

The Directive discussed above is a response by the European Commission to the same economic and regulatory problems that the Postal Regulatory Commission is charged with addressing. While the European context differs somewhat from that which exists in the U.S., previous

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[70]   See Directive of the European Parliament and of the Council amending Directive 97/67/EC, concerning the full accomplishment of the internal market of Community postal services, 2006, at Article 14.

statements by the Postal Regulatory Commission indicate that it shares several of the goals underlying this directive. One principle underlying the EU directive is that prices should reflect "normal commercial conditions and costs" with limited exceptions, a condition that is important "both for the financial equilibrium of the universal service as well as for limiting market distortions."[71] Similarly, the EU Directive stresses that "prices must be cost-oriented,"[72] much like the Commission's stated requirement that all products cover the costs they impose on the Postal Service. While the actions needed to meet this requirement are open to some degree of interpretation, it is my opinion that a failure to correctly assign responsibility for common costs via the appropriate share mechanism leaves the Commission short of achieving that goal.

D. PRACTICAL GUIDANCE AND RECOMMENDATIONS

Determining the appropriate share of institutional costs to be covered by competitive products is equivalent to asking how responsibility for coverage of fixed costs should be divided between competitive and market dominant products.[73] The discussion above – including private sector practice, the existence of soft cost causation, and precedent from the European Union – points to an adoption of appropriate share that is more in line with competitive products' current share of attributable costs. This conclusion holds true and is easily implemented regardless of whether the Commission does or does not adopt Proposals One and Two.

While some of the concepts I have put forth might justify use of some alternate measures one might use for proportional allocation, these alternatives tend to hold less intuitive appeal than attributable cost. For example, using volume (piece count) would be an inappropriate choice, given the inherent differences in products; a piece of standard mail is very different from a piece

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[71] See Directive of the European Parliament and of the Council amending Directive 97/67/EC, concerning the full accomplishment of the internal market of Community postal services, 2006, at p. 16.

[72] See Directive of the European Parliament and of the Council amending Directive 97/67/EC, concerning the full accomplishment of the internal market of Community postal services, 2006, at p. 22.

[73] This formulation assumes that the Commission agrees that inframarginal costs should be attributed to products, and no longer treated as institutional.

of Express Mail, and a claim that each requires the same amount of centralized costs seems farfetched. Using revenue instead would in essence assign the fixed cost burden in a manner that fails to consider costs. Using attributable cost is a much more logical alternative, and is widely used in the private sector. Furthermore, this method of attributing "common costs" is the approach taken by the European Union in its directive on the topic.[74]

All of these considerations suggest that the share of fixed costs that should be paid for by competitive products should be guided by the share of total attributable costs that are associated with competitive products.

Proposal Three has suggested that this "appropriate share" should be based on the average share of total Postal Service attributable costs that are attributed to competitive products over the three preceding years, and that it could be self-adjusting. In the most recent three year period (FY2012-FY2014), this share averaged 24.6%. However, if such a rule had been in place in FY2014, the calculation of appropriate share would have reflected the FY2011-FY2013 period, which would have yielded 20.7%. In order to give the Commission a sense of the significance of increasing the appropriate share, I have calculated the cost impact associated with increasing the appropriate share to 20.7% and then applying that to using cost data from the 2014 ACR. As Table 17 demonstrates, competitive products' burden would exceed their current contribution by roughly $2.8 billion. This impact has been calculated assuming nothing else changes. However, the ultimate impact of Proposal Three would depend on whether Proposals One and Two are also adopted.

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[74] See Directive of the European Parliament and of the Council amending Directive 97/67/EC, concerning the full accomplishment of the internal market of Community postal services, 2006, at Article 14.

Table 17: Proposal Three Cost Impact for FY2014 (FY14 $ Millions)

		Current Competitive Contribution		Proposal Three	
		Share	Cost	Share	Cost
		[1]	[2]	[3]	[4]
Total Market Dominant Attributable Costs	[A]		28,205		28,205
Total Competitive Attributable Costs	[B]		10,970		10,970
TOTAL ATTRIBUTABLE COSTS	[C]		39,175		39,175
Market Dominant Share	[D]	87.4%	29,877	79.3%	27,110
Competitive Share	[E]	12.6%	4,310	20.7%	7,077
OTHER COSTS	[F]		34,187		34,187
TOTAL COSTS	[G]		73,362		73,362
Total Market Dominant Costs	**[H]**		**58,082**		**55,315**
Total Competitive Costs	**[I]**		**15,280**		**18,047**

Notes and Sources:

[1]: FY14 ACR Competitive Contribution = (Competitive Revenue – Competitive Attributable Costs) / Other Costs.

[2]: Costs as reported in the FY14 Public Cost and Revenue Analysis (PCRA) applied to appropriate share in [1].

[3]: Appropriate share for FY2014 under Proposal Three (average attributable cost share for FY2011 – FY2013).

[4]: Costs as reported in the FY14 PCRA applied to appropriate share in [3].

[5]: Ultimate appropriate share under Proposal Three.

[6]: Costs as reported in the FY14 PCRA applied to appropriate share in [5].

[A],[B]: Attributable costs as reported in FY14 PCRA.

[C]: [A] + [B].

[D][2]: [F][2] x [D][1].

[D][4]: [F][4] x [E][3].

[D][6]: [F][6] x [D][5].

[E][2]: [F][2] x [E][1].

[E][4]: [F][4] x [F][3].

[E][6]: [F][6] x [E][5].

[F]: Other costs as reported in FY14 PCRA.

[G]: Total costs as reported in the FY14 PCRA.

[H]: [A] + [D].

[I]: [B] + [E].

Appendix A

Office: Washington, DC ♦ Phone: +1.202.955.5050 ♦ Email: Kevin.Neels@brattle.com

Dr. Kevin Neels directs the Transportation Practice at *The Brattle Group*. Dr. Neels has more than 30 years experience as a consultant and expert witness in the rail, trucking, courier, postal, aviation, and automotive industries. He has led many significant engagements relating to competition, market structure, pricing, revenue management, distribution strategy, regulation, and public policy. His work has addressed issues related to system planning, competition policy, privatization, and congestion management.

Prior to joining *The Brattle Group*, Dr. Neels served as Vice President and leader of the transportation practice at Charles River Associates. He has also served as a researcher in the Urban Policy Program at the Rand Corporation and the Transportation Studies Program at the Urban Institute, as a Director in the Transportation Practice at the consulting firm of Putnam, Hayes & Bartlett, and as a Management Consultant in the Transportation Practice of the firm now known as KPMG. Dr. Neels is a former Chairman of the Committee on Freight Transportation Economics and Regulation of the Transportation Research Board, an arm of the National Academy of Sciences. He is also a member of the Transportation Research Board's Committee on Airline Economics and Forecasting.

Dr. Neels has authored numerous research reports, monographs and articles for peer-reviewed journals. He has often been asked to offer expert testimony in legal and regulatory proceedings. He regularly serves as an invited speaker at conferences and industry forums, and his opinions and observations on industry developments are frequently quoted in the popular and trade press. Dr. Neels earned his Ph.D. from Cornell University.

A sample of the project experience of Dr. Neels is shown below.

EXPERIENCE

Freight Transportation

- ♦ Dr. Neels served as the principal competition witness for the acquiring party in a proceeding before the Surface Transportation Board regarding the merger of the two largest short line railroad holding companies in the U.S. In connection with this work he analyzed every point of contain between the rail systems owned by these two companies, an analyzed the competitive implications of placing the combined networks under common control.

- ♦ For an Ex Parte proceeding before the Surface Transportation Board Dr. Neels provided written testimony regarding procedures for settling disputes over the reasonableness of rail transportation rates. His testimony related to aspects of the Standalone Cost methodology employed by the Board in resolving these disputes, focusing in particular on the role that third party traffic plays in such analyses, and the manner in the revenues associated with such traffic are assigned to different portions of the routes followed by such traffic. His testimony discussed the typical structure of North American freight rail networks, and the roles that gathering, branch and main lines play in assuring the overall economic viability of the network as a whole.

- ♦ For a major U.S. based freight railroad, Dr. Neels developed a system of models to predict traffic levels and revenues by carrier for the North American freight rail market under alternative scenarios regarding market structure and regulatory policy. This modeling system incorporated detailed representations of the North American rail and highway networks, algorithms for determining shipment routing under alternative operating policies, and a series of statistical models capturing the underlying structure of freight traffic flows.

- ♦ For a non-U.S. government client, Dr. Neels led the team serving as fairness advisors in connection with the privatization of a government owned railroad. This engagement involved review of and commentary upon the bidding procedures employed in the transaction, analysis of the extent to which different bidders addressed and resolved policy concerns expressed by government officials, and advising government officials regarding the extent to which the various bids received reflected the full market value of the operation.

- ♦ On behalf of a provider of services to long-distance trucking firms, Dr. Neels offered expert testimony on the status of the trucking market, and on the extent to which a downturn in that market affected the value and economic viability of trucking firm service providers during a period in which his client concluded a series of acquisitions.

- ♦ In testimony before the U.S. Postal Rate Commission, Dr. Neels offered expert testimony analyzing the procedures used by the U.S. Postal Service to measure the transportation costs associated with its various products. His analysis addressed a wide range of issues, including the Service's use of its dedicated air network for transportation of expedited products, fieldwork procedures used to collect data on composition of the mail stream at different points in the rail network, potential biases in the assignment of transportation costs to products, and flaws in econometric analyses of transportation cost variability introduced by other witnesses in the proceeding.

- ♦ In support of a key economic witness in a hearing regarding refined petroleum product pipeline rates before the Federal Energy Regulatory Commission, Dr. Neels conducted an analysis of the relationship between product prices in the different geographic areas linked by the pipeline system.

He also examined alternative transportation modes and concentration in the pipeline's origin markets.

♦ For a major U.S. railroad involved in a commercial dispute over trackage rights and trackage fees, Dr. Neels conducted a detailed analysis of over-the-track incremental operating costs. This analysis involved, among other things, extensive use of the Uniform Rail Costing System maintained by the Surface Transportation Board.

♦ For a major North American rail car manufacturer involved in a patent infringement lawsuit Dr. Neels offered expert testimony on the economic value of an innovative car design relative to existing designs, and on the damages imposed on the manufacturer as a result of infringement of its patents on this new design.

♦ For an express package delivery carrier intervening in a rate case before the U.S. Postal Rate Commission, Dr. Neels conducted a critical review of econometric studies of cost variability introduced into evidence by a witness testifying on behalf of the U.S. Postal Service. He identified a number of serious conceptual and methodological flaws in this analysis, and demonstrated that the substantive conclusions of the analysis were sensitive to relatively minor change in its design. On the basis of his testimony the Commission rejected the arguments of the Postal Service in the Commission's final ruling.

Airline Industry

♦ For a major U.S. network air carrier Dr. Neels was a key member of a team of consultants charged with the development of an operations research strategy aimed at improving the carrier's performance and competitive standing across a broad range of areas of operation, including financial planning, scheduling, crew management, maintenance, flight operations, air cargo sales, marketing, reservations and distribution. This engagement involved extensive onsite interviews with numerous operating personnel at the carrier's headquarters. It identified a lengthy list of investment opportunities involving the application of a variety of advanced decision support tools.

♦ For a major international air carrier accused of monopoly leveraging and attempted monopolization of a key market, Dr. Neels prepared a report analyzing the carrier's use of corporate discounts and travel agent override commissions, and rebutting arguments that these agreements could be construed as exclusive dealing.

♦ For a major U.S. air carrier, Dr. Neels conducted an extensive empirical investigation of the responses of travel agents to carriers' incentive and override programs. Using the results of this investigation, he evaluated his client's sales force management and travel agent incentive strategies to identify specific ways in which redesign and or retargeting could increase their net revenue yields.

♦ Working on behalf of a major air carrier in an antitrust case involving allegations of predatory pricing, Dr. Neels worked directly with the lead litigator for the case to develop a strategy to guide discovery. Subsequently, he conducted a variety of econometric analyses measuring the extent to which plaintiffs were harmed by the alleged predation.

♦ For a consortium of major U.S. air carriers accused of engaging in collusion and price fixing, Dr. Neels directed a major economic analysis of industry pricing strategy and pricing dynamics.

Drawing upon detailed data on daily fare changes, Dr. Neels prepared testimony and exhibits demonstrating the difficulty of engaging in coordinated pricing behavior.

♦ In an antitrust dispute in the airline industry, Dr. Neels was retained by the defendant to critique and rebut damage calculations prepared by experts for plaintiffs. Dr. Neels conducted a detailed analysis of the assumptions underlying plaintiff estimates of lost profits, documenting numerous instances in which specific assumptions were contradicted by industry experience or by business plans prepared by the plaintiff prior to litigation. He showed that correcting these errors resulted in dramatic reductions in estimates of plaintiff damages. The case was eventually dismissed without an award of damages.

♦ Dr. Neels assisted in the preparation of statistical exhibits and an expert affidavit for submission by a major U.S. carrier in a rulemaking proceeding regarding airline computerized reservation systems conducted by the U.S. Department of Transportation.

♦ To support expert testimony in an antitrust case between two major U.S. air carriers, Dr. Neels developed and estimated a set of statistical models for estimating the effects of GDS display bias on the booking patterns and revenues of the affected airlines. As part of this effort Dr. Neels conducted an extensive analysis of the histories of the carriers in questions and of the development of these computerized systems as the primary channel of distribution for airline tickets. He also prepared damage estimates, assisted in the deposition of opposing expert witness, prepared trial exhibits and advised counsel on cross-examination strategy during the course of the trial.

Airport and Airway System

♦ For the International Air Transport Association, Dr. Neels conducted an analysis and critique of a proposed change in the structure of air traffic control user charges levied on foreign carriers entering the U.S. and overflying its territory. He pointed out a number of serious flaws in the empirical analysis that formed the basis for the new system of charges. Implementation of the new charges was halted by a federal judge.

♦ Dr. Neels played a critical role in a project for the Air Transport Association (ATA) of the United States to evaluate proposals for reforming the nation's air traffic control (ATC) system and to develop an effective financial and organizational structure for a reformed ATC. The plan, developed under extremely tight deadlines, required an assessment of ATC technological capabilities, estimation of the cost effects of ATC on the airline industry, an economic analysis of current and proposed ATC organizational forms and detailed financial assessment of proposed ATC entities. Dr. Neels presented his analysis and proposal to airline chief executive officers at a meeting of the ATA board.

♦ For the public authority responsible for the operation of one of the largest international gateway airports in the country, Dr. Neels conducted a comprehensive review of sources of information on air cargo movements. Based upon the results of this review, he worked with authority staff to devise a strategy for monitoring trends in shipments by ultimate origin and destination, commodity, carrier and type of service, and for factoring this information into an improved process for planning and executing air cargo facility improvements.

♦ For the operator of a major U.S. hub airport, Dr. Neels developed a series of forecasting models for use in evaluating likely passenger responses to the introduction of new types of ground access services.

♦ For the government of a Mexican province, Dr. Neels developed a framework for use in evaluating proposals for new airport development.

♦ For a conference sponsored by the National Academy of Sciences, Dr. Neels analyzed the policy issues raised by proposals for using pricing to manage demand and reduce delays at major airports. His analysis used standard antitrust tools to assess the extent of concentration in the market for airport services, and evaluated the potential for anticompetitive behavior in that market.

♦ To support the development of an airport system plan for a major metropolitan area, Dr. Neels prepared long-range activity forecasts for air carriers, regional airlines and general aviation.

♦ For an international gateway airport, he evaluated the impacts and effectiveness of a wide range of strategies for reducing delays. The policies considered included regulatory constraints on aircraft size, diversion of service to adjacent airports, a variety of pricing and slot allocation mechanisms, and expansion of facility capacity.

Aerospace Manufacturing

♦ For a foreign manufacturer of high end business jet aircraft Dr. Neels offered testimony on the structure of the market within which these aircraft are sold and the relationship between this market and the market aftermarket retrofits and modifications. His testimony examined the turnover of the existing fleet of high end business jet aircraft, trends over time in resale values, the relationship between new aircraft sales and trade-ins of previously owned aircraft, and the factors influencing the commercial success of aftermarket modifications under FAA supplemental types certificates.

♦ For a consortium of aerospace manufacturers, Dr. Neels examined and evaluated the economic, financial and policy arguments for including manufacturers as members of government sponsored insurance against war and terrorism risks. His analysis examined the nature of the risks in question, the state of the commercial market for insurance against them, the realities of multi-party tort litigation in settings where the parties enjoy dramatically different levels of insurance coverage, and the likely long-term economic impacts if aerospace manufacturers were because of the shut down of the commercial insurance market, forced involuntarily to self-insure against these risks.

♦ For a major manufacturer of business jet aircraft accused of monopoly leveraging and attempted monopolization Dr. Neels conducted an analysis of the structure of the business jet aircraft market, evaluating the extent to which availability of comparable models from other manufacturers constrained the ability of the defendant in the dispute to exercise market power.

♦ For a U.S. based manufacturer of business aircraft, Dr. Neels quantified the damages resulting from significant defects in a major subcontractor-supplied aircraft component. These defects had resulted in a number of plane crashes and the eventual grounding of a significant portion of the manufacturer's fleet. Dr. Neels developed a sophisticated econometric model that controlled for the effects of a number of market-related background factors, and isolated the effects of the component defects on sales, revenues and profits.

♦ For a manufacturer of high end business jet aircraft involved in a dispute over the closure of a manufacturing plant, Dr. Neels offered expert testimony on the status of the business jet aircraft market at the time of the closure and its effects on new orders, backlog and revenue for the manufacturer. His analysis focused in particular on the effects on the business jet aircraft market of the economic downturn that began in 2001 and the events on September 11, 2001. In response to testimony offered by opposing experts, he also analyzed the decision making process that led to closure of the plant, the options open to management, and the economic justifications for closing the plant.

Automotive Industry

♦ For a group of automobile dealers, he conducted an econometric analysis to quantify the extent to which these dealers had suffered economic injury as a result of a scheme in which executives of the auto manufacturer accepted bribes from a subset of dealers in exchange for providing them with extra allotments of highly profitable car models. The settlement of this litigation awarded a payment of several hundred million dollars to the non-bribe paying dealers.

♦ For a major auto manufacturer contemplating litigation over an alleged theft of trade secrets, he developed a system of economic forecasting models to calculate the effects of the theft of sales of the company's products in a number of major international markets. Results of this confidential investigation played a key role in the company's subsequent decision to seek redress through the courts.

♦ For a group of automobile dealers engaged in a dispute with a distributor, Dr. Neels offered expert testimony analyzing the new auto allocation procedures used by the distributor, the distributor's policies regarding accessorization of new vehicles, and their economic effects of individual dealers. This work involved extensive econometric modeling of the dynamics of dealer inventories and the determinants of time to sale for individual vehicles.

♦ For a consortium of U.S., European and Japanese auto manufacturers and related firms, Dr. Neels played a key role in a major investigation of long-term trends in mobility. This study was worldwide in scope, addressing urban, rural and intercity passenger and freight transportation in both the developed and the developing world. Its particular focus was on the sustainability of the current transportation system, and the extent to which exhaustion of fossil fuels, environmental constraints, infrastructure shortages or institutional barriers were likely to constrain mobility over the next several decades.

Other Project Experience

♦ For an operator of vehicle and passenger ferry services to offshore islands, Dr. Neels conducted a detailed analysis of fares, costs, market structure, the extent to which particular services are subsidized, the structure of the market for ferry services, and the likely effects of changes in conditions of entry.

♦ For a major U.S. manufacturer that had been the target of industrial espionage and the organized theft of technology and other trade secrets, Dr. Neels offered testimony involving the stolen technology and, using a reasonable royalties approach, the damages suffered by the U.S.

manufacturer as a result of the theft. At the conclusion of a jury trial in the United States, the manufacturer received a substantial damage award.

♦ For the U.S. Department of Energy, Dr. Neels conducted an extensive investigation of the technological, institutional and economic factors influencing the demand for residential heating fuels.

♦ For a Gas Research Institute study of natural gas usage in the steel industry, Dr. Neels provided consultation on statistical issues and worked closely with a team of analysts examining the economics of fuel substitution.

♦ Dr. Neels directed the team of economists responsible for conduct of the damages study for plaintiff in a major patent infringement lawsuit in the consumer products industry. His work included development of econometric models to forecast product sales in eight major world markets, analysis of the effects of incremental changes in sales volumes on company profits, review of historical pricing strategies and calculation of economic damages for a wide range of "but-for" pricing and product introduction strategies. He and his team also played a key role in the analysis of the case put forth by the opposing side and in the development of cross-examination strategies for opposing expert witnesses. He was designated as an expert witness in this matter, but was not called upon to testify.

♦ As leader of a project funded jointly by the Ford Foundation, the U.S. Department of Housing and Urban Development and a consortium of local corporations, Dr. Neels directed a year-long study by the Rand Corporation of strategies for privatizing municipal services in Saint Paul, Minnesota. A major component of this project was a detailed analysis of the incentives created by different financing mechanisms, organizational structures and personnel management systems. Findings of the study were published in a major report entitled *The Entrepreneurial City*.

♦ Dr. Neels played a major role in the preparation of expert testimony on behalf of a group of major domestic oil companies accused of conspiring to depress the prices paid to producers of a major input to tertiary oil recovery projects. This testimony focused on an examination of purchase contracts involving the defendants to establish market prices for the input in question over the alleged damage period.

♦ For the New York State Science and Technology Foundation, Dr. Neels participated in a project to facilitate the transfer to civilian firms and the commercial exploitation of photonics technology developed for military applications at a research center established at a major New York State military installation. This project included an assessment of the commercial value of the technology, the identification of firms in the vicinity of the research center with the research focus and capabilities to absorb the technology, and the design of institutional mechanisms for facilitating and supporting technology transfer.

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